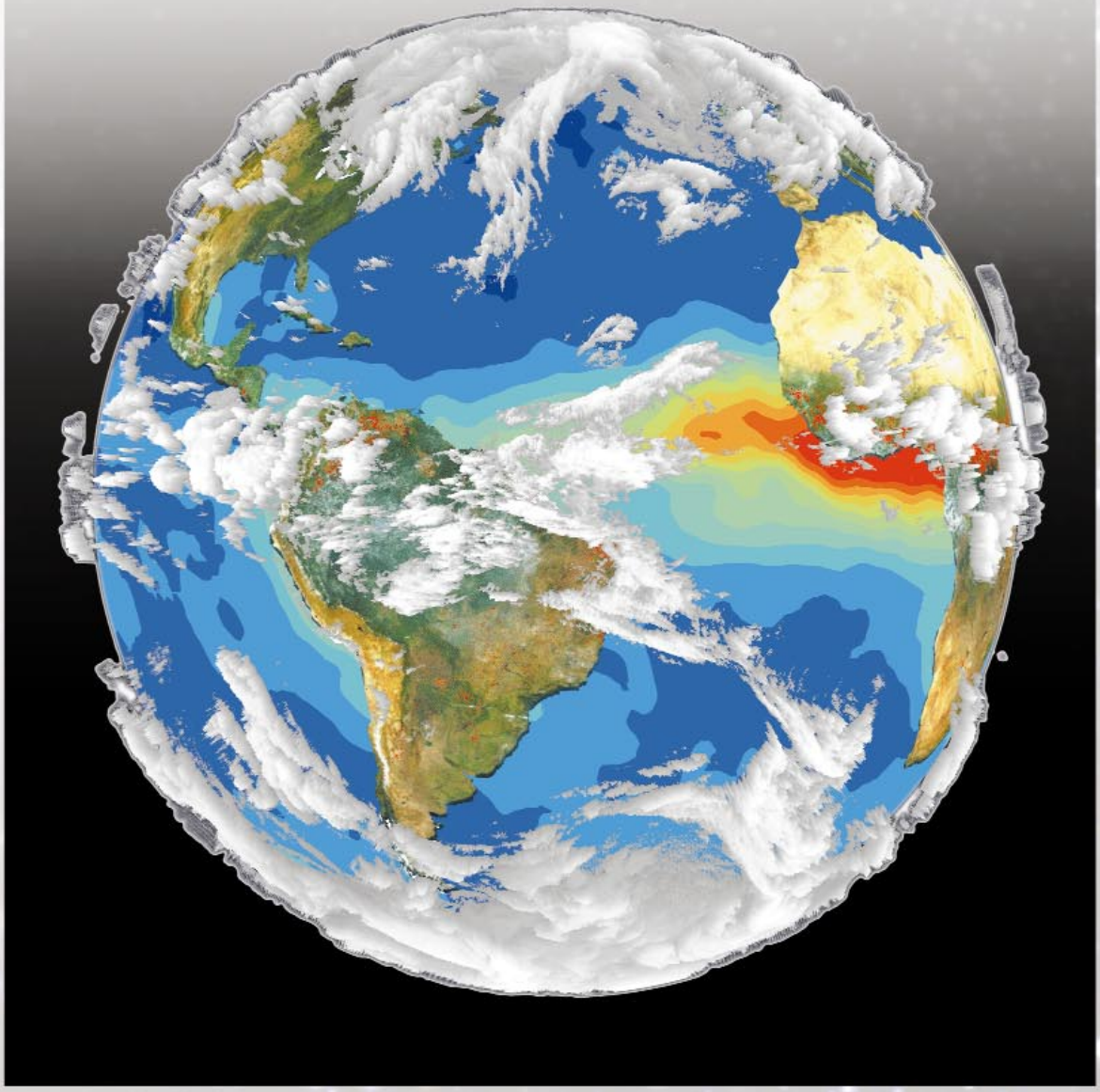
1999
CONSOLIDATED REPORT



COMMITTEE EARTH OBSERVATION SATELLITES

CEOS

TABLE OF CONTENTS

Chapters

Appendices

Cover Image:
The cover image is a compilation of data from NASA, NOAA, ESA and NASDA satellites that remotely sense vegetation, clouds, fires over land and aerosols over the ocean. The land image layer is a composite of SeaWiFS land vegetation data for cloud-free conditions from September 18 to October 3, 1997. Each dot over South America and Africa represents a fire location detected by the Advanced Very High Resolution Radiometer (AVHRR) in January 1993. The oceanic aerosol layer is based NOAA's AVHRR aerosol data product for December, January and February 1990 and 1991. The aerosol layer is a result of biomass burning and windblown dust emitted over Africa. The cloud layer is a composite of infrared images from four geostationary weather satellites: GOES 8, GOES 9, METEOSAT and GMS 5. The compilation was created by Washington University.

INTRODUCTION

This Consolidated Report provides an overview of the activities of the Committee on Earth Observation Satellites (CEOS) during the time period November 1998-October 1999. The Report also includes a concise overview of the history, purpose and accomplishments to date of CEOS and its working groups. The Consolidated Report was originally prepared at the request of the CEOS membership to provide background for new and prospective CEOS members, as well as for other organizations or individuals with an interest in CEOS activities. As part of its contribution to the CEOS Secretariat, NASA updates the Report annually before each Plenary meeting, typically held in the fall.

On behalf of the CEOS Secretariat, NASA would like to thank all CEOS agencies that contributed to this edition of the Consolidated Report.

Any comments or corrections to this document should be forwarded to:

Ms. Leslie Charles
NASA CEOS Point of Contact
NASA Headquarters
Code IY
300 E Street, S.W.
Washington, D.C. 20546
USA
+1-202-358-0864 (voice)
+1-202-358-2798 (fax)
leslie.charles@hq.nasa.gov

Additional copies of this report can be obtained through the CEOS Secretariat or on-line at *http://www.earth.nasa.gov/whatis/ceos/report.html*.

CHAPTER 1: CEOS OVERVIEW

The Committee on Earth Observation Satellites (CEOS) is an international organization charged with coordinating international civil spaceborne missions designed to observe and study planet Earth. Comprised of 39 space agencies and other national and international organizations, CEOS is recognized as the main international forum for the coordination of Earth observation satellite programs and for interaction of these programs with users of satellite data and information worldwide.

CEOS was created in 1984, in response to a recommendation from the Economic Summit of Industrialized Nations Working Group on Growth, Technology, and Employment's Panel of Experts on Satellite Remote Sensing. This group recognized the multidisciplinary nature of satellite Earth observation and the value of coordination across all proposed missions. Thus, under the original name of International Earth Observations Satellite Committee (IEOSC), CEOS combined the previously existing groups for Coordination on Ocean Remote-Sensing Satellites (CORSS) and Coordination on Land Remote-Sensing Satellites (CLRSS), and established a broad framework for coordinating all spaceborne Earth observation missions.

Individual participating agencies use their best efforts to implement CEOS recommendations. The main goal of CEOS is to ensure that critical scientific questions relating to Earth observation and global change are covered and that satellite missions do not unnecessarily overlap each other. The three primary objectives of CEOS are:

- to optimize benefits of spaceborne Earth observations through cooperation of its participants in mission planning and in development of compatible data products, formats, services, applications and policies;
- to serve as a focal point for international coordination of space-related Earth observation activities; and
- to exchange policy and technical information to encourage complementarity and compatibility of observation and data exchange systems.

A current main activity of CEOS is working with the IGOS Partnership, created in 1998, on the development of the Integrated Global Observing Strategy (IGOS). IGOS intends to unite the major satellite and ground-based systems for global environmental observations and monitoring of the atmosphere, oceans, land and life, in a framework that delivers maximum benefit and effectiveness in their final use. IGOS focuses on the observing dimension of the process of providing environmental information for decision-making, while linking research and operational programs as well as data producers and users.

CEOS meets in Plenary annually, with activities and coordination occurring throughout the year. The Chairperson of CEOS rotates at the annual Plenary. The CEOS Chairperson for 1999 is the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT); for 2000, it will be the Instituto Nacional de Pesquisas Espaciais (INPE) of Brazil; and for 2001, it will be the Science and Technology Agency (STA) jointly with the National Space Development Agency (NASDA) of Japan. A permanent Secretariat provides most of the coordination between plenary sessions and is maintained by the European Space Agency (ESA), the National Aeronautics and Space Administration (NASA) jointly with the National Oceanographic and Atmospheric

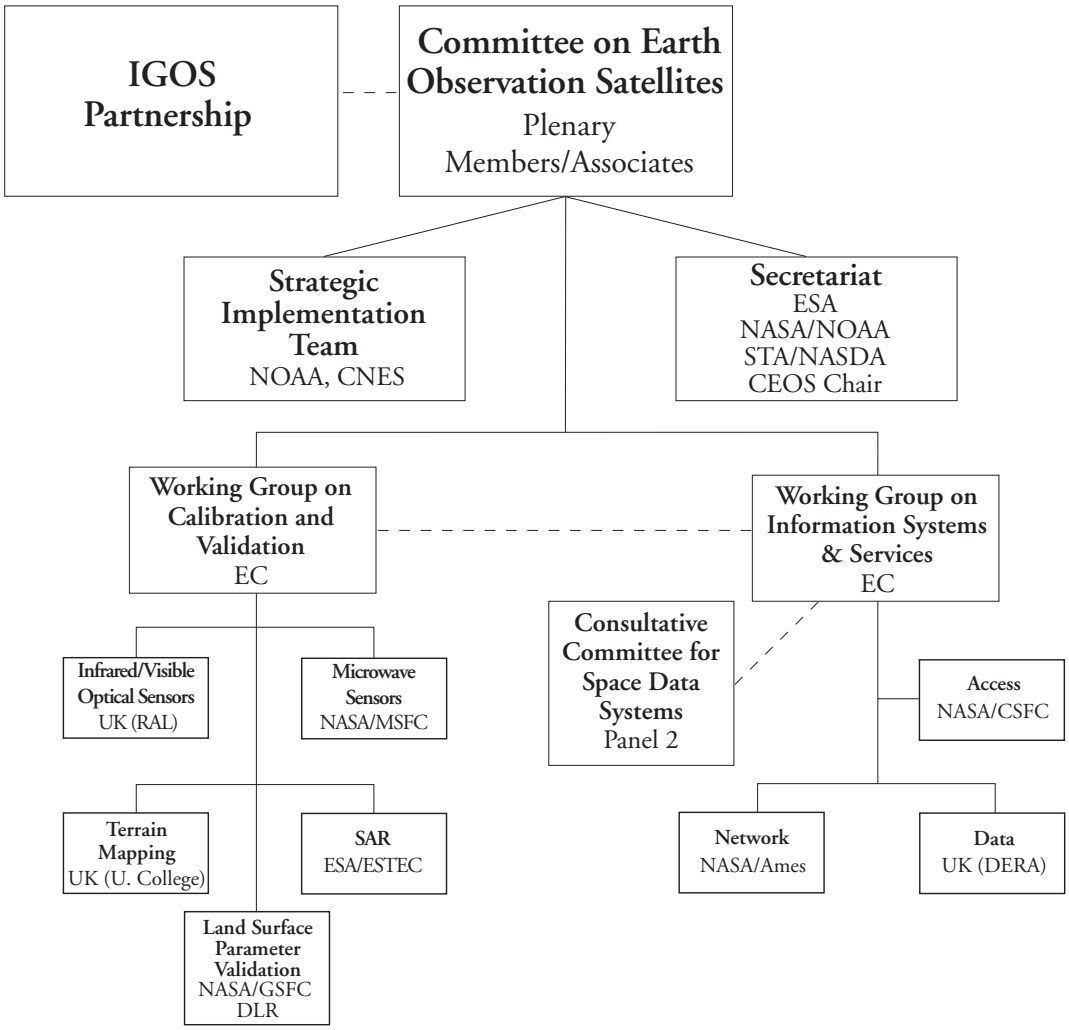
Administration (NOAA) of the United States, STA/NASDA of Japan, and is headed by the CEOS Chair organization.

CEOS currently has two working groups, which meet regularly. The objectives of the Working Group on Calibration and Validation (WGCV), which meets approximately every nine months, are to enhance coordination and complementarity, to promote international cooperation and to focus activities in the calibration and validation of Earth observations for the benefit of CEOS agencies and the international user community. WGCV addresses sensor specific calibration/validation and geophysical parameter and derived product validation. The objective of the Working Group on Information Systems and Services (WGISS) is to facilitate data and information management and services for users and data providers in dealing with global, regional and local issues. In particular, WGISS addresses the capture, description, processing, access, retrieval, utilization, maintenance and exchange of spaceborne Earth observation data and supporting ancillary and auxiliary data and information, enabling improved interoperability and interconnectivity of information systems and services. WGISS meets approximately every six months.

CEOS issues a number of information products and services which are available from the Secretariat or the CEOS homepage: *http://www.ceos.org* (see also Appendix B). The CEOS Newsletter is published twice a year and contains general information about the activities of CEOS between Plenary sessions. In addition, both the WGCV and WGISS publish newsletters. CEOS maintains a database on member Earth observation systems and user requirements. CEOS has issued a CD-ROM on applications and education, which is designed for use primarily by developing countries and educators. The CEOS Information Locator System (CILS) is a prototype electronic information service designed primarily to meet the requirement of users of Earth observation and remote sensing data in developing countries. The CEOS International Directory Network (IDN) is an international effort to assist researchers in locating information on available data sets. The IDN is sponsored by WGISS as a service to both the Earth and space science communities. The IDN provides open, online access to information on worldwide scientific data including Earth sciences, space physics, solar physics, planetary science and astronomy/astrophysics.

This document, the CEOS Consolidated Report, is prepared annually, in preparation for the fall Plenary session, and contains overview information about CEOS activities in 1999 and some overall history.

CEOS STRUCTURE



As of 11/99

CHAPTER 2: CEOS TERMS OF REFERENCE

PREAMBLE

Remote sensing from space has evolved from an early period of limited satellite programs to a point where distinctions among existing missions result from the technology employed, rather than from the disciplines served in system operations. In the future, a number of international and national spaceborne Earth observations systems will operate simultaneously and support both interdisciplinary and international activities.

The organization of international cooperation in spaceborne Earth observations systems also is evolving, from mission-specific reviews to the interdisciplinary coordination of multi-mission programs. Beginning with the first Multilateral Meeting on Remote Sensing held in Ottawa on May 8-9, 1980, which was attended by agency representatives from Canada, the European Space Agency (ESA), France, India, Japan and the US, current and potential operators of Earth observations systems have met several times to discuss the means by which mutually beneficial cooperation and coordination could be achieved in both the near and longer term. As a result of these gatherings, the recent past has seen the creation of the Coordination on Land Observation Satellites (CLOS) by agency representatives from France, Japan and the U.S. in Paris on November 13-14, 1980; the initiation of CORSS in Paris on May 10-11, 1982, through the efforts of agency representatives from ESA and Japan; and the second Multilateral Meeting on Remote Sensing held in Paris on May 12-13, 1982, attended by agency representatives from France, Canada, ESA, India, Japan and the U.S.

This framework of initial discussion and cooperation has enhanced the utility of spaceborne Earth observations data to users worldwide, has encouraged the coordination of program plans among spaceborne Earth observations system operators, and had fostered international receptivity to and acceptance of spaceborne Earth observations system activities and applications.

Consequently, the assembled representatives of international and national spaceborne Earth observations systems affirmed the following:

AWARE of the overlap of spaceborne Earth observations mission objectives and of the interdisciplinary applications of remotely sensed data, RECOGNIZING the advantages of ongoing communication and cooperation among spaceborne Earth observations system operators, and DESIRING to promote the international growth and potential benefits of spaceborne observations of the Earth, CEOS members have affirmed the value of the activities described above and have agreed to coordinate informally their current and planned systems for Earth observations from space through the organization of a Committee on Earth Observation Satellites (CEOS).

Cooperation in the development and management of remote sensing and associated data management programs can be of benefit to operators of spaceborne Earth observations systems and to users of Earth observations data. Redundancy among systems and the utility of data can be optimized through the appropriate coordination of complementary and compatible space and ground segments, data management practices and products and Earth observations systems research and development.

CEOS will not supersede current or potential agreements by Members. Participation in the activities of CEOS will not be construed as being

binding upon spaceborne Earth observations system operators, or as restricting their right to develop and manage Earth observations systems according to their needs.

OBJECTIVES

CEOS has three primary objectives:

- To optimize the benefits of space borne Earth observations through cooperation of its Members in mission planning and in the development of compatible data products, formats, services, applications and policies;

- To aid both its Members and the international user community by inter alia serving as the focal point for international coordination of space-related Earth observation activities, including those related to global change;

- To exchange policy and technical information to encourage complementarity and compatibility among spaceborne Earth observations systems currently in service or development, and the data received from them; issues of common interest across the spectrum of Earth observations satellite missions will be addressed.

Individual Members of CEOS will use their best efforts to implement CEOS recommendations in their respective Earth observations programs.

PARTICIPANTS

Members
Governmental organizations that are international or national in nature and are responsible for a civil spaceborne Earth observations program currently operating, or at least in Phase B or equivalent of system development, will be eligible for membership in CEOS. Members must have a continuing activity in spaceborne Earth observations, intended to operate and provide non-discriminatory and full access to data that will be made available to the international community. The addition of Members will be with the consensus of current Members of CEOS. Request for membership should be addressed to the Chairperson of the next scheduled CEOS Plenary session. The Members at that meeting will consider such requests.

Associates
The following may be invited to participate through the status of Associate:

1. Governmental organizations that are international or national in nature and currently have a civil space-segment activity in Phase A/pre-Phase A or equivalent of system development, or a significant ground-segment activity that supports CEOS objectives;

2. Other existing satellite coordination groups and scientific or governmental bodies that are international in nature and currently have a significant programmatic activity that supports CEOS objectives.

Addition of Associates will be by consensus of existing Members. Associates may participate fully in CEOS Plenary and working group discussions, and have their views included in reports; however, approval by Associates will not be required to establish consensus. The autonomy of both the associated organizations and the respective national and international Earth observations programs will remain intact. Membership in CEOS does not automatically assume membership in the respective associated organizations.

CHANGE OF STATUS

It is the responsibility of each Member and Associate to inform the CEOS Chairperson of a change in its status with regard to CEOS participant eligibility as outlined in the Terms of Reference. In the event that an organization's status changes, CEOS Members will review the change and change in status will be by consensus of the CEOS Members.

COOPERATIVE ACTIVITIES

CEOS Members will exchange technical information on and pursue the potential for coordination of space and ground segments. Such coordination could include discussions on current and future mission parameters, sensor capabilities and intercalibration, and data and telemetry downlink characteristics. In addition, Earth observations systems coordination within CEOS could address issues of ground station technical compatibility for backup satellite tracking, command and control, and sensor and telemetry data reception.

CEOS Members will investigate the means for increasing data utility and cost-effectiveness, for both operators and users. CEOS activity could include the coordination of data acquisition, sampling, and pre-processing methodologies; the standardization of data formats where appropriate; the increase in compatibility of data archives; and the enhancement of user access to CEOS Member databases, information products, and services. CEOS Members will seek to ensure that the user community is made aware of the satellite programs of Members and will encourage discussions between the users and relevant satellite system operators, as necessary.

CEOS Members will present their plans for emerging satellite remote-sensing technologies and programs, and will discuss appropriate approaches for the coordination of future systems. CEOS Members will address current developments and future direction/opportunities in Earth observations from space, including free-flying spacecraft, mission-specific instruments flown on space transportation systems, and the placement of instruments on space platforms.

ORGANIZATION AND PROCEDURES

CEOS will convene once every year in Plenary session. CEOS meetings will be organized and chaired by the designated host organization. Each Member and Associate will designate a point-of-contact for coordination between meetings. Each Member and Associate should inform the CEOS Chairperson of principal and point-of-contact changes.

A standing Secretariat will be maintained by ESA, NASA/NOAA and STA/NASDA and chaired by the incoming host organization in support of the CEOS Plenary. Each year's incoming Plenary host agency will lead the activities of the Secretariat for that year. In addition, to ensure the expeditious conduct of business, the past and the forthcoming CEOS chairs will be included in the CEOS Secretariat. The Secretariat will prepare and distribute the minutes for the Plenary meetings, serve as a point-of-contact for external organizations interacting with CEOS, maintain and update the CEOS Dossier on space and ground segment activities, produce other periodic publications, ensure communications among members between meetings, report at each Plenary session on its activities and the status of action items from previous Plenary meetings and perform other tasks as assigned by the CEOS Plenary. The chairpersons of the CEOS working groups will be invited to all meetings of the CEOS Secretariat and will be copied on all relevant correspondence. The Plenary guides the work of the Secretariat, with CEOS Member points-of-contact serving as a steering committee in between Plenary sessions.

At each meeting of CEOS, the time, place and host for at least the next two meetings will be established. The incoming CEOS host will assume chairperson responsibilities at the conclusion of the Plenary meeting. Allocation of Plenary actions will be coordinated between the incoming and outgoing chairpersons.

A list of Members and Associates and the dates they were accepted will be updated as appropriate, included as Appendix A to the Terms of Reference, and distributed with the minutes after each meeting.

CEOS also may establish, as mutually agreed and on an *ad hoc* basis, special temporary working groups to investigate specific areas of interest, cooperation and coordination and to report at subsequent Plenary meetings. Continuation of each *ad hoc* working group requires confirmation at each Plenary session. Conclusions resulting from CEOS Plenary sessions, or the findings and recommendations of *ad hoc* working groups, will be acted upon at the discretion of each CEOS Member.

CEOS may establish, as mutually agreed, standing working groups where an *ad hoc* status is deemed insufficient. More permanent status may be required to ensure long-term continuity of work in certain areas where the magnitude and complexity of the task is not suitable to short-term solutions. These standing working groups shall continue without requiring specific confirmation by the Plenary. The Chairpersons of such groups shall report at each CEOS Plenary session on accomplishments and future plans. If the consensus of the Plenary is that such a group is no longer required, the Plenary may discontinue the group. In the absence of such a decision, however, the standing working group shall continue. Representatives from all CEOS Members and Associates are invited to participate in all working groups.

CEOS will replace the Multilateral Meeting on Remote Sensing, CLOS, and CORSS. During the development of and action on CEOS activities, themembers of CEOS will follow the example of the successful international technical and programmatic cooperation achieved by the Coordination on Geostationary Meteorological Satellites. CEOS Members also will consider the issues, concepts, and conclusions arrived at in previous gatherings of the Multilateral Meeting on Remote Sensing, CLOS and CORSS, and will address current and future activities of spaceborne Earth observing systems.

CEOS will consider and may make recommendations and agree on actions to promote appropriate coordination across satellite coordination groups, and national and international satellite programs. Furthermore, CEOS encourages its members to maintain communication as appropriate with other groups and organizations involved in spaceborne Earth observation activities and applications through the relevant channels within their respective governments.

ADOPTION AND AMENDMENT

These Terms of Reference were adopted at the September 24-25, 1984, meeting of CEOS and were amended by consensus at the second meeting of CEOS, held at the European Space Research Institute (ESRIN) in Frascati, November 10-12, 1986. Additional amendments were made at the third meeting of CEOS in Ottawa, Canada, April 4-5, 1989; the fourth meeting in Sao José dos Campos, Brazil, November 13-14, 1990; the sixth meeting in London, UK, December 9-11, 1992; the seventh meeting in Tsukuba, Japan, November 16-18, 1993; on October 10, 1996, before the tenth meeting in Canberra, Australia; and at the twelfth meeting in Bangalore, India, November 10-12, 1998. They may be further amended by consensus of the Members.

Adopted 9/25/84
Washington, D.C.
USA

Amended 11/11/86
Frascati, Italy

Amended 4/5/89
Ottawa, Canada

Amended 11/14/90
San José dos
Campos, Brazil

Reconfirmed 12/10/91
Washington, D.C., USA

Amended 12/11/92
London,
United Kingdom

Amended 11/18/93
Tsukuba, Japan

Amended 10/10/96
Canberra, Australia

Amended 11/12/98
Bangalore, India

LIST OF CEOS AGENCIES

Organization	Location	Date of Membership
Members		
Agenzia Spaziale Italiano (ASI)	Italy	1986
British National Space Centre (BNSC)	U.K.	1986
Canadian Space Agency (CSA)	Canada	1984
Centre National d'Etudes Spatiales (CNES)	France	1984
Chinese Academy of Space Technology (CAST)	China	1993
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Australia	1989
Deutsches Zentrum für Lüft- und Raumfahrt (DLR)	Germany	1986
European Commission (EC)	Brussels	1994
European Organisation for the Exploitation of Meterological Satellites (EUMETSAT)	Darmstadt	1989
European Space Agency (ESA)	France	1984
Indian Space Research Organisation (ISRO)	India	1984
Instituto Nacional de Pesquisas Espaciais (INPE)	Brazil	1984
National Aeronautics and Space Administration (NASA)	U.S.	1984
National Oceanic and Atmospheric Administration (NOAA)	U.S.	1984
National Remote Sensing Centre of China (NRSCC)	China	1993
National Space Agency of Ukraine (NSAU)	Ukraine	1993
Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)	Russia	1992
Russian Aviation and Space Agency (Rosaviakosmos)	Russia	1992
Science and Technology Agency (STA)/National Space Development Agency (NASDA)	Japan	1984
Swedish National Space Board (SNSB)	Sweden	1991
Associates		
Canada Centre for Remote Sensing (CCRS)	Canada	1990
Crown Research Institute (CRI)	New Zealand	1990
Federal Office for Scientific, Technical and Cultural Affairs (OSTC)	Belgium	1993
Global Climate Observing System (GCOS)	Geneva	1992
Global Ocean Observing System (GOOS)	Paris	1992
Global Terrestrial Observing System (GTOS)	Rome	1996
Intergovernmental Oceanographic Commission (IOC)	Paris	1991
International Council of Scientific Unions (ICSU)	Paris	1991
International Geosphere-Biosphere Program (IGBP)	Stockholm	1991
International Society for Photogrammetry and Remote Sensing (ISPRS)	Bethesda	1997
Satellite Applications Centre (SAC)/South African Council for Scientific and Industrial Research (CSIR)	South Africa	1998
Norwegian Space Centre (NSC)	Norway	1990
United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)	Bangalore	1996
United Nations Environment Program (UNEP)	Nairobi	1992
United Nations Food and Agricultural Organization (FAO)	Rome	1993
United Nations Office of Outer Space Affairs (UNOOSA)	Vienna	1994
World Climate Research Program (WCRP)	Geneva	1991
World Meteorological Organization (WMO)	Geneva	1991

CHAPTER 3: CEOS SECRETARIAT

OVERVIEW

The 1992 Plenary created a permanent, tripartite Secretariat to support increasing administrative requirements and to provide consistency and continuity in CEOS activities. As stated in the CEOS Terms of Reference, the Secretariat is maintained by ESA, NASA/NOAA and STA/NASDA and chaired by the incoming host organization in support of the CEOS Plenary. ESA is responsible for liaison with CEOS members and candidate members in Europe and Africa, NASA/NOAA in the Americas and STA/NASDA in the Asia Pacific region. Each year's incoming Plenary host agency leads the activities of the Secretariat for that year. In addition, to ensure the expeditious conduct of business, the past and the forthcoming CEOS chairs are included in the Secretariat. The chairpersons of the CEOS working groups are invited to all meetings of the Secretariat.

In general, the Secretariat prepares and distributes the minutes for the Plenary meetings, serves as a point-of-contact for external organizations interacting with CEOS, maintains and updates the CEOS Dossier on space and ground segment activities, produces other periodic publications, ensures communications among Members and Associates between meetings, reports at each Plenary session on its activities and the status of action items from previous Plenary meetings and performs other tasks as assigned by the CEOS Plenary. The Plenary guides the work of the Secretariat.

1999 SECRETARIAT HIGHLIGHTS

During 1999, the Secretariat came together several times in meetings and teleconferences to follow up the decisions and recommendations of the 1998 Plenary and associated meetings. A major thrust of the Secretariat over the past year has been to provide support as members of the Strategic Implementation Team (SIT) Organizing Committee in planning the January and June 1999 SIT meetings. The Secretariat has also been active in ensuring an effective CEOS contribution to the IGOS Partnership. Other important activities were the CEOS participation in the UNISPACE III conference and forging better links between Plenary and the Working Groups. More generally, the CEOS Secretariat has undertaken a number of outreach activities to promote CEOS and its objectives, and at the same time to publicize the work of the IGOS Partnership. Brief accounts of the various activities are given in the following paragraphs.

- ***Development of the IGOS Partnership & Implementation of IGOS.*** The Secretariat was involved in numerous activities connected with the IGOS Partnership that was formally created in June 1998. The importance that the CEOS Plenary attaches to the IGOS Partnership inevitably means that the subject requires significant Secretariat support. The Secretariat provides members for the IGOS Partnership Liaison Group, which is responsible for progressing IGOS Partnership matters between meetings of the Partnership. In 1999, the Secretariat assisted in the planning, conduct and follow up of the IGOS Partnership meeting in June and November. In addition, as a contribution to the IGOS Partnership, STA/NASDA led the Secretariat in the development and publication of the recently released *IGOS Brochure*. Similarly, CNES is spearheading the production of the *IGOS Bulletin*, and NASA registered the IGOS Partnership

Home Page: *http://www.igosparters.org*.

Besides CEOS, the IGOS Partnership currently includes the Sponsors of the Global Observing Systems (ICSU, FAO, UNEP, IOC- UNESCO, UNESCO and WMO), the Global Observing Systems (Climate, Terrestrial and Ocean observing systems), IGFA, IGBP and WCRP. The Partnership aims to advance the definition, development and implementation of IGOS in a joint manner.

- ***Fourth & Fifth Meetings of the SIT.*** The SIT Organizing Committee planned and conducted the Fourth SIT meeting in La Jolla in January 1999 and the fifth meeting in Rome in June 1999. All CEOS Members that had previously indicated interest in IGOS were invited to participate in these meetings which were intended to take forward the CEOS contribution to the IGOS Partnership, and to consider the future of the initial set of IGOS demonstration projects. In particular, these meetings developed the Theme approach for IGOS, which was subsequently accepted in principle by the June 1999 IGOS Partnership meeting.

- ***CEOS Participation in UNISPACE III.*** The Secretariat took the necessary actions to effect the decision made at the Twelfth Plenary regarding the CEOS participation in UNISPACE III. A combined CEOS and IGOS stand was arranged and staffed in the exhibition, and received many visitors. Presentations were made at the UNISPACE III Plenary and Technical sessions, and the Secretariat worked together with FAO and other IGOS Partners to arrange a daylong technical session on IGOS. As a result of these activities, which had started with CEOS Secretariat representation and participation in the UNISPACE Regional Preparatory meetings, both CEOS and IGOS are mentioned in the appropriate parts of the final Vienna declaration.

- ***Outreach Activities.*** In response to Plenary's wish to promote awareness of CEOS and its activities (especially, although not exclusively, its work with the IGOS Partnership), the Secretariat arranged to make presentations at a number of international meetings, such as the Ministerial Conference on Space Applications for Sustainable Development in Asia (New Delhi, November 1999) and the UNESCO/ICSU World Conference on Science (Budapest, June 1999). In addition, the Secretariat provided a lecture on international cooperation in Earth Observation to an international symposium on electronics (Queretaro, September 1999). The Secretariat also contributed a short article on CEOS for the Encyclopedia of Global Change and an update to the CEOS entry in the Yearbook of International Organizations.

- ***CEOS Display.*** Each Secretariat agency has a copy of the CEOS tabletop display for use at meetings and conferences in order to promote awareness of CEOS and its activities. As with all CEOS and IGOS publications, any CEOS member can request the display for use. In 1999, the Secretariat arranged for the display to be used at UNISPACE III along with poster-sized blow-ups from the IGOS Brochure, as well as at the Queretaro lecture.

- ***CEOS Partnerships.*** Following the 12th Plenary's recommendation for CEOS to have more regular contacts with the commercial sector, several informal meetings were arranged (for example, in association with UNISPACE III and the IAF Congress) to seek the views of the private sector. A recommendation will be made to the 13th Plenary on this subject.

- ***1999 Consolidated Report.*** As part of its contribution to the CEOS Secretariat, NASA updated and published the annual *CEOS Consolidated Report*, which is sent to all

CEOS Members in advance of each Plenary.

- ***CEOS Newsletter.*** As part of its contribution to the CEOS Secretariat, NASDA published the twelfth and thirteenth issues of the *CEOS Newsletter*.

- ***1999 Plenary Preparations.*** In preparation for the Thirteenth CEOS Plenary, the Secretariat is working with the current CEOS Chairperson (EUMETSAT) on the agenda, membership issues and the preparation of papers. The Secretariat is also actively involved in the preparations for the Fourth IGOS Partnership meeting, which is to be held in Stockholm during the period of the CEOS Plenary.

POINTS OF CONTACT

Secretariat points of contact and coordinates can be found in Appendix A.

CHAPTER 4:
BRIEF CEOS HISTORY

The CEOS Plenary has convened 13 times since 1984—12 in formal Plenary sessions and once in interim session. Summaries of each of the Plenary meetings are presented below.

HIGHLIGHTS OF THE 1998 BANGALORE PLENARY MEETING (Twelfth Plenary)

Note: The Second IGOS Partners Meeting was also held in Bangalore on November 10, 1998, under the Chairmanship of Dr. K. Kasturirangan, Chairman of CEOS for 1998. In addition to CEOS, the host for the meeting, FAO, IGBP, UNEP, WMO, WCRP, IGFA, GCOS, GOOS and ICSU attended the meeting.

The Twelfth Plenary:

- Endorsed formally CEOS participation in the IGOS Partnership and preparation of the space component strategy for IGOS. See Chapter 7.

- Endorsed the continuation of the Strategic Implementation Team (SIT), as an *ad hoc* group under CEOS. SIT, under the chairmanship of Mr. Robert Winokur, formerly of NOAA, and vice-chairmanship of Dr. Jean-Louis Fellous of CNES, is tasked with developing the IGOS space component strategy. SIT will evaluate and guide the set of six CEOS demonstration projects for transition into the framework of the IGOS Partnership. The SIT will report on these issues at the Thirteenth CEOS Plenary.

- Reviewed the status of the six CEOS demonstration projects identified to help define the IGOS concept: Long Term Continuity of Ozone Measurements; Upper Air Measure-ments; Global Ocean Data Assimilation Experiment (GODAE); Global Observation of Forest Cover (GOFC); Long Term Ocean Biology Measurements and Disaster Management Support. Specific observation requirements have been identified, and it is hoped that CEOS agencies will consider these requirements when drafting their mission plans.

- Recharacterized CEOS membership criteria. Formerly divided into three categories (Members, Observers, and Affiliates), CEOS agencies now fall in two categories (Members and Associates). Members are space agencies with EO missions currently operating or in an advanced stage of development. Associates are agencies and organizations with civil space-segment activity in Phase A/pre-Phase A or equivalent of system development, or with significant ground-segment activity that supports CEOS objectives. The CEOS Terms of Reference were revised to reflect this change and adopted by Plenary. See Chapter 2.

- Admitted the Satellite Application Centre (SAC) of the South African Council for Scientific and Industrial Research (CSIR) as an Associate of CEOS. CEOS is currently comprised of 21 Members and 18 Associates.

- Recognized a need to develop mechanisms to establish a forum for private sector participation and interaction with CEOS. Plenary envisioned that this would involve jointly organized CEOS and private sector events, such as workshops or symposia.

- Agreed to help organize, jointly with FAO

and other IGOS Partners, a one-day technical forum on IGOS at the UNISPACE III conference in Vienna, July 1999. See Chapter 7.

- Endorsed the Working Group on Calibration and Validation (WGCV) and the Working Group on Information Systems and Services (WGISS) reports and encouraged CEOS agencies to provide both Working Groups with continued support.

- Dr. Tillmann Mohr of EUMETSAT was named Chairperson for 1999, taking over from Dr. Krishnaswamy Kasturirangan of ISRO.

HIGHLIGHTS OF THE 1997 TOULOUSE PLENARY MEETING (Eleventh Plenary)

- Reaffirmed CEOS' involvement in the development of IGOS and decided to maintain the Strategic Implementation Team (SIT) as an *ad hoc* CEOS group mandated to strengthen the cooperation between CEOS, IGFA and the Sponsors Group for the Global Observing Systems (Global Climate, Ocean and Terrestrial Observing Systems, or G3OS). [1] SIT was also tasked to develop the space component for an IGOS strategic plan.

- Accepted the recommendation of the Analysis Group that it be disbanded and asked the SIT to take over tracking the IGOS Projects.

- Endorsed the WGCV and the WGISS reports and encouraged CEOS agencies to provide both Working Groups with continued support.

- Expanded CEOS membership to include the International Society on Photogrammetry and Remote Sensing (ISPRS) as an Affiliate.

- Launched the second version of the CEOS CD-ROM dedicated to developing countries and education.

- Encouraged CEOS agencies to urge their national administration to take appropriate action to protect the frequency bands for Earth observation satellite systems.

- Commissioned a small group to consider broadening partnership/membership in CEOS and present specific recommendations to the Twelfth Plenary.

HIGHLIGHTS OF THE 1996 CANBERRA PLENARY MEETING (Tenth Plenary)

- Accepted recommendations from the March 1996 *ad hoc* CEOS meeting on the space component of an IGOS and endorsed the concept of an IGOS.

- Created 1) the Strategic Implementation Team (SIT) to develop an overall strategy for the stepwise implementation of the IGOS space component, and 2) the Analysis Group (AG) to continue the work of the *ad hoc* Task Force on Planning and Analysis (which was not renewed) by analyzing the extent to which the data products from existing and planned satellites meet the needs identified through by CEOS Affiliates.

- Revised the Terms of Reference to reflect broader participation by CEOS Affiliates and Observers.

- Commended WGISS for its progress during its first year.

- Reviewed and endorsed the five-year plans of WGISS and WGCV.

- Launched a new CD-ROM aimed at developing countries and educational purposes. The CD-ROM contains case studies, data sets, lesson plans, scientific texts and other information on the social value of Earth observation.

[1] The G30S Sponsors Group is comprised of FAO, ICSU, UNEP, UNESCO-IOC and WMO.

- Focused on the issue of protecting required frequencies for Earth observation in preparation for the WRC-97. Also addressed database protection in the context of the World Intellectual Property Organization (WIPO).

- Endorsed the continued work of the CEOS-IGBP High Resolution Data Project, the International Ocean Color Coordination Group (IOCCG) and the CEOS Information Locator System.

- Accepted EUMETSAT's offer to compile an annual report on CEOS agency activities with developing countries.

- Using data from the then-newly launched ADEOS satellite, demonstrated the world's first real-time intercontinental relay of Earth observation satellite information.

- Confirmed Affiliate status for the Global Terrestrial Observing System (GTOS) and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

- Debuted a tabletop display to be used at international conferences and other fora to promote awareness of CEOS and its activities.

HIGHLIGHTS OF THE 1995 MONTREAL PLENARY MEETING (Ninth Plenary)

- Accepted the initial recommendations of the *ad hoc* Task Force on Planning and Analysis, including creation of an on-line database format for the Dossier, to enable comparative requirements analyses. The Task Force's mandate was extended for one year, to allow time to accomplish the work and conduct a preliminary analysis.

- In addition, to enhance CEOS long-term planning activities, accepted a proposal for CEOS to hold an *ad hoc* meeting to explore its possible involvement in international efforts to coordinate an integrated global observing strategy.

- Created the Working Group on Information Systems and Services (WGISS) through the merger and re-direction of the Working Group on Data (WGD) and the Working Group on International Network Services (WGINS).

- At the request of the Intergovernmental Oceanographic Commission (IOC), endorsed a resolution on ocean color data. The resolution supports CEOS participation in international efforts to foster the best collective use of various ocean color sensors to be launched by different nations over the next decades.

- Reviewed several projects in support of developing countries, including the CEOS Information Locator System (CILS), the CD-ROM educational training package, and the calendar of airborne campaigns and use of the web site containing information about high-resolution satellites and their data. The CEOS developing country strategy was revised to include specific technical areas for cooperation.

- Acknowledged the effectiveness of the CEOS Open Fora, the CEOS Newsletter, the CEOS Special Report on Successful Applications of Earth Observation Satellite Data and the 1995 CEOS Yearbook, entitled "Coordination for the Next Decade."

HIGHLIGHTS OF THE 1994 BERLIN PLENARY MEETING (Eighth Plenary)

- Celebrated the tenth anniversary of CEOS and conveyed a joint resolution by the governments of CEOS Members and Observers confirming the importance of CEOS and supporting its objectives.

- Approved the European Commission's (EC) change in status from Observer to Member and confirmed the United Nations Office of Outer Space Affairs (UNOOSA) as an Affiliate.

- Endorsed the Resolution on Principles of Satellite Data Provision in Support of Operational Environmental Use for the Public Benefit.[2] See Appendix for text.

- Updated the CEOS Future Strategy and endorsed the CEOS Strategy Toward Developing Countries. Approved a plan for the implementation of the strategic goals, including analysis and planning within the CEOS Future Strategy.

- Formed an *ad hoc* Task Force on Planning and Analysis to cross-correlate the user requirements and capabilities documented in the CEOS Dossiers and report back to the Ninth Plenary.

- Accepted the recommendations of the Second User Requirements Workshop, including efforts to update and improve the CEOS Dossier and address regional user requirements within the CEOS context.

- Accepted the five-year implementation plans of the Working Groups.

- Created the Interim WGINS to continue the work of the *ad hoc* Working Group on Networks (WGN), which was thus disbanded.

HIGHLIGHTS OF THE 1993 TSUKUBA PLENARY MEETING (Seventh Plenary)

- Received reports from the WGD and the WGCV, and endorsed their plans for continued work.

- Expanded CEOS membership to include National Remote Sensing Center of China (NRSCC) and the National Space Agency of Ukraine (NSAU); confirmed Affiliate status for the United Nations Food and Agriculture Organization (FAO).

- Began discussion on a future CEOS strategy, and adopted criteria to assess proposals to CEOS.

- Reinforced the Affiliates' definition and integration of data requirements

- Accepted the proposal to hold an *ad hoc* data policy meeting to discuss data exchange principles in support of operational/environmental monitoring (public utility).

- Established an *ad hoc* Working Group on Networks (WGN).

- Accepted a proposal from Brazil to host a workshop to identify activities to support developing countries, and to propose a plan of action for consideration at the Eighth CEOS Plenary.

- Began planning for the CEOS Tenth Anniversary.

HIGHLIGHTS OF THE 1992 LONDON PLENARY MEETING (Sixth Plenary)

- Increased CEOS membership to include the Russian Space Agency (RSA), the Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET) and the Chinese Academy of Space and Technology (CAST); added as Observers the Federal Office for Scientific, Technical, and Cultural Affairs of Belgium (at the time of inclusion, known as Belgian Science Policy Office (SPO)) and the National Remote Sensing Center of China (NRSCC).

- Reinforced and expanded ongoing dialogue between CEOS Members and Affiliates

[2] With EUMETSAT abstaining.

regarding long-term observing plans and user requirements.

- Finalized Data Exchange Principles in Support of Global Change Research (see Appendix F for full text), and established process for demonstrating their application in support of the IGBP.

- Endorsed establishment of a permanent tripartite CEOS Secretariat.

- Debuted the CEOS Dossier.

HIGHTLIGHTS OF THE 1992 LONDON INTERIM PLENARY MEETING

In April 1992, CEOS Members met for an interim Plenary in London with senior national and regional environmental officials from 15 countries, the EC, ESA and EUMETSAT. The joint meeting of CEOS and environmental officials resulted in an initiative aimed at improving dialogue among the space agencies and environmental users and increasing the use of satellite data to support the information needs of national and international environmental programs. The initiative included five elements:

- Recognize, encourage and support the work of CEOS in providing a forum for international coordination on satellite missions, data calibration and validation, networking, data exchange policy and space data provider and user communications;

- Encourage and facilitate the provision of information on satellite missions and data to national and international environmental programs;

- Urge and encourage national and international environmental programs to formulate data needs and priorities;

- Encourage the efforts of countries and international environmental programs that are currently developing the potential to contribute to Earth observation satellite programs and to the processing and analysis of data;

- Make the efforts of CEOS better known within the user community, and foster the widest use of satellite data.

A statement of relevant existing and planned satellite missions, drawn from the CEOS Dossier, was made available to delegates at the United Nations Conference on Environment and Development (UNCED), held in Brazil that year. All participants were encouraged to pursue the objectives of the above initiative to the fullest extent possible, within available resources. The CEOS Affiliates made plans to meet to bring together environmental user needs, which would serve as the basis for further discussion with the CEOS Members at the December 1992 Plenary meeting.

HIGHLIGHTS OF THE 1991 WASHINGTON, DC, PLENARY MEETING (Fifth Plenary)

- Expanded CEOS membership to include the Swedish National Space Board (SNSB), endorsed the active participation of Affiliates from major international scientific and intergovernmental organization user bodies—the International Council of Scientific Unions (ICSU), IGBP, IOC, the World Climate Research Program (WCRP), and the World Meteorological Organization (WMO)—and welcomed representatives from the State Meteorological Administration of the People's Republic of China attending as guests.

- Adopted the Resolution on Satellite Data Exchange Principles in Support of Global Change Research.

- Agreed to prepare a document describing the space and ground segments of CEOS Members, measurements to be taken, launch dates, and user requirements integration.

- Established the WGCV as a standing Working Group and accepted its Terms of Reference.

- Endorsed WGD accomplishments, and instructed the WGD to proceed with plans for the CEOS International Directory Network (IDN) and to coordinate requirements for the 1-km Advanced Very High-Resolution Radiometer (AVHRR) global land data set.

- Agreed to send CEOS representatives to the Global Climate Observing System (GCOS) Joint Scientific and Technical Committee, the WMO Executive Council Panel of Experts on Satellites and the Space Agency Forum on International Space Year (SAFISY).

HIGHLIGHTS OF THE 1990 SAO JOSE DOS CAMPOS PLENARY MEETING (Fourth Plenary)

- Rededicated CEOS Plenary to focus on unique role played in representing Earth observation system operators, and on enhanced outreach to international scientific, policy and intergovernmental groups.

- Modified Terms of Reference regarding commitment to provide non-discriminatory and full access to data, and analyzed proposal from US to establish data exchange principles for global change research.

- Created the Working Group on Space-to-Ground Networks (WGSN).

HIGHLIGHTS OF THE 1988 OTTAWA PLENARY MEETING (Third Plenary)

- Consolidated Earth observations satellite coordination groups through termination of the International Forum for Earth Observations using Space Station Elements (IFEOS) and transferred remaining functions to CEOS.

- Created new membership category of "Observer" to ensure opportunities for participation by all potential contributors.

- Expanded CEOS membership to include Australia and EUMETSAT, with the EC and New Zealand invited to become Observers.

- Established WGD as a standing Working Group and accepted its Terms of Reference. Future direction of WGD is to emphasize polar platform, networking, and random access media.

- Emphasized importance of revitalizing calibration/validation coordination.

HIGHLIGHTS OF THE 1986 FRASCATI PLENARY MEETING (Second Plenary)

- Expanded CEOS membership to include the British National Space Centre (BNSC) of the United Kingdom, the Deutsches Agentur für Raumfahrtangelegenheiten (DARA) of Germany and the Agenzia Spaziale Italiano (ASI) of Italy.

- Shared satellite failure analysis reports.

- Approved continuation of WGD as standing body able to serve as control authority for data formats.

- Approved use of WGD as focal point for polar platform data management coordination, and urged coordination with Consultative Committee on Space Data Systems (CCSDS).

- Approved continued work of WGCV, with direction to include non-CEOS agencies with relevant expertise and resources.

- Endorsed the International Space Year (ISY).

HIGHLIGHTS OF THE 1984 WASHINGTON, DC, PLENARY MEETING (First Plenary)

- Formal CEOS Terms of Reference adopted.
- Focused on all Earth observation missions regardless of discipline.
- Emphasized service to users (data, training, information dissemination).
- Created *ad hoc* Working Group on Data (WGD) and Working Group on Calibration and Validation (WGCV).

CHAPTER 5: WORKING GROUP ON CALIBRATION AND VALIDATION

The CEOS Working Group on Calibration and Validation (WGCV) has met in formal session fifteen times since its inception. The sixteenth meeting is scheduled for March 2000. ESA chaired the group from 1984 to 1990, followed by Canada until November 1996 when the chair transferred to the EC.

The WGCV membership continues to increase, including new CEOS Members and Associates. The group recognized early on that many non-CEOS organizations play a key role in Earth observation calibration and validation activities. As such WGCV activities have always been open to experts with relevant knowledge; invited speakers from organizations such as the National Institute of Standards and Technology in the US and the National Physical Laboratory from the UK are a continuing feature of WGCV meetings. In 1999 their participation has led to a close examination of traceability issues. The implications are far-reaching and WGCV will convene a special *ad hoc* group, with a life of one year, to look in depth at the issue of traceability and its long-term consequences.

An expanded WGCV home page is also strengthening the outreach aspect of the WG's work.

The terms of reference for the WGCV and its subgroups are given in Appendix D. The points of contact for members of the WGCV and its subgroups are provided in Appendix A. Additional information can be obtained via the URLs listed in Appendix B.

SUMMARY AND OBJECTIVES

The ultimate goal of the WGCV is to ensure long term confidence in the accuracy and quality of Earth observation data and products. WGCV has two specific tasks. These are firstly sensor-specific calibration and validation, and secondly geophysical parameter and derived product validation.

Calibration is defined by WGCV as "the process of quantitatively defining the system response to known, controlled signal inputs," and validation as "the process of assessing by independent means the quality of the data products derived from the system outputs."

To ensure long term confidence in the accuracy and quality of Earth observation data and products, the WGCV provides a forum for calibration and validation information exchange, coordination and cooperative activities. The WGCV promotes the exchange of technical information and documentation, joint experiments, and the sharing of facilities, expertise and resources among its members as appropriate. The WGCV also seeks to be the recognized first point-of-contact for the international user community as far as calibration and validation information is concerned.

With the advent of the Integrated Global Observing Strategy (IGOS) the WGCV has devoted increased attention to the validation of higher level products. This culminated in an *ad hoc* WGCV meeting held in London, May 1999. The workshop identified a trend towards producing higher level products, and that it is harder to validate these than it is to generate them, especially as the costs of obtaining field data for validation are high, particularly in proportion to the non-satellite budget of the observing systems. The workshop concluded that coordinated international validation initiatives would be beneficial to multiple space agencies, maximizing limited resources for land product validation. A recommendation was made to the WGCV to convene a new sub-group to examine Land Surface Parameter Validation,

and a mandate for such a group was drafted. Following the meeting such a group was convened, with co-chairs drawn from North America (NASA) and Europe (DLR).

WGCV SUBGROUPS

In 1999, WGCV decided to expand and now comprises five sub-groups: Infrared and Visible Optical Sensors (IVOS) Microwave Sensors (MS), Synthetic Aperture Radar (SAR), Terrain Mapping (TM), and the newest sub-group–Land Surface Parameter Validation (LSPV).

Infra-red and Visible Optical Sensors subgroup - chaired by Christopher Mutlow, Rutherford Appleton Laboratory, held its last meeting in April 1999 at the Andøya Rocket Range hosted by the Norwegian Space Center. The IVOS sub-group addressed cross-calibration between spaceborne sensors, and actions dealing with cal/val of ocean color satellite sensors continue. IVOS stresses the importance of on-board calibration for infrared and visible sensors arising from growing user awareness and user demand.

The Microwave Sensors subgroup - chaired by Elena Lobl, NASA, met in April 1999 in Huntsville, and September 1999 in El Segundo, California. The group continues to address cal/val issues surrounding active sensors and their data, especially validation of the TMI sensor on-board TRMM launched in November 1997 and specifically address the specification of measurement uncertainty in remote sensing.

The SAR subgroup - chaired by Yves-Louis Desnos, ESA/ESTEC, is preparing for the annual workshop to be held in Toulouse on 26-29 October 1999. The workshop will be hosted by CNES and is being jointly organized by CNES and ESA. Specialist papers are invited to review the performance of existing and planned airborne and spaceborne SAR sensors.

The Terrain Mapping subgroup - chaired by Ian Dowman, University College London, met in London, May 1999, as a joint activity with ISPRS WGII/4, WGIII/6 and the WGCV *ad hoc* meeting on land surface parameter validation. The meeting highlighted the need to prepare recommendations for the establishment of a global GCP network; to consider how orbit validation could be developed; to produce a statement of DEMs available; and to produce DEM requirements document with a science rationale.

The Land Surface Parameter Validation subgroup – co-chaired by Stefan Dech, DLR Oberpfaffenhofen, and Jeffrey Privette, NASA GSFC, will hold its first meeting at the Canada Center for Remote Sensing in spring 2000. The meeting will focus on validation of products associated with the Global Observations of Forest Cover project.

WGCV ACTIVITIES

Following the actions, guiding principles and recommendations of the WGCV's Strategic Vision Document the WGCV has embarked on a three year work plan. The main elements are described below.

WGCV Web Site

The WGCV Secretariat hosts and maintains a World Wide Web (WWW) site at: *http://wgcv.ceos.org.*

This contains background material, contact details for members and links to non-CEOS sites dealing with calibration and validation issues. The goal is for the WGCV web site to become a first port of call for anyone seeking cal/val information.

The site is being expanded to list conferences. New introductory material is being prepared, and a slide set providing generic cal/val examples is being prepared; slide sets related to specific cal/val topics will follow.

The web site will also contain key references and reference sites as compiled by the WGCV subgroups. Copies of WGCV newsletters are avail-

able. Minutes of the latest WGCV meetings are available.

WGCV Dossier
This dossier provides information on calibration laboratories, on test sites and instruments in a uniform way. The dossier development, led by NASA, will continue over the next three years. The Dossier can be found at: *http://spso.gsc.nasa.gov/calval/homepage.html.*

Linkages to Non-CEOS Groups
To improve liaison with organizations lacking CEOS representation, WGCV will invite individuals to meetings as technical experts. Representation from developing countries is particularly important for validation, where local expertise is needed worldwide. The WGCV recognizes that funding for participation may be a problem. However, it was felt that if invitations were made in the context of special sessions, funding might be easier to find. WGCV will invite experts from developing countries in this context, and CEOS Associates will be asked to identify relevant individuals. Most WGCV subgroup meetings already feature one specialist session, and all subgroup chairs agreed that this would continue.

Coordination and Implementation of Validation Activities
Validation will form a focus for WGCV's work over the coming years, and the creation of the new subgroup is expected to act as a focus for international efforts in land surface parameter validation. Other areas will continue to be addressed by the other four subgroups.

Seven initial projects are being used to analyze issues such as accuracy requirements, measurement and sampling protocols, test site(s), data management requirements and implications for all participating CEOS organizations. Parameters include Visible/Near-Infrared Top-of Atmosphere reflectance (these are a critical first step to creation of derived parameters such as Leaf Area Index); Sea Surface Temperature validation; intercomparison of Digital Terrain Model generation from optical and microwave data; Wind Speed; Significant Wave Height; Wave Frequency; and Wave Direction.

WGCV Future Plans
Though validation activities are WGCV's primary concern at present, this in no way implies that sensor calibration is a "done job." Calibration will remain an on-going task, and WGCV will endeavor to ensure that the best possible information on instrument calibration is made available to the widest possible audience. In particular, the debate on traceability continues. It is considered desirable that all operating agencies ensure SI measurements are traceable to international standards. There is also a need for agencies to demonstrate and confirm accuracies claimed, not just by a simple declaration but by independent verification through either peer or auditor review. Those agencies with experience should share that experience with those who do not and WGCV will act as a focus for this discussion.

The work on the subgroups' validation pilot projects will continue, and WGCV will adapt its work as appropriate in the light of the developments of IGOS.

CHAPTER 6: WORKING GROUP ON INFORMATION SYSTEMS AND SERVICES

The CEOS Working Group on Information Systems and Services (WGISS) was created in 1995 as the successor to the Working Group on Data (WGD) and the Interim Working Group on International Network Services (WGINS). Typically, WGISS holds two meetings per year. In 1999, WGISS held two workshops in addition to its eighth and ninth plenary meetings: these addressed "IPR and Data Policy" and "Is there Earth Observation outside the OECD?"

The overall objective of WGISS is to facilitate data and information management and services for users and data providers, including the capture, description, processing, access, retrieval, utilization, maintenance and exchange of Earth observation data from satellites and supporting auxiliary data and information. Most of the technical work of WGISS is carried out in subgroups and Task Teams.

The goals and activities of WGISS are summarized in its Five-Year Plan. Version 3.0 of this plan was presented at the CEOS Plenary in 1998 and received endorsement. The annual update of the Plan is underway, and a Version 4.0 is on track for presentation to the 1999 Plenary.

The terms of reference for the WGISS and its subgroups are given in Appendix D. The points of contact for members of WGISS and it subgroups are provided in Appendix A. Additional information can be obtained via the URLs listed in Appendix B.

WGISS ACTIVITIES IN 1999

- WGISS is very interested in becoming involved with the IGOS initiative, particularly because of the opportunities it offers for outreach to the user community, including users in developing countries. WGISS can support the CEOS pilot projects and IGOS themes through tools, techniques and recommended practices for:
  - data identification, locating data needed for the projects;
  - data delivery, using and establishing advanced network capabilities; and
  - data preparation, including formatting and geometric transformation, to support interuse of data.
- WGISS also recognizes the need for promotion and outreach efforts. These needs have been investigated under the initiative of the WGISS Strategy Task Team, which held its first meeting in May 1997. It agreed to focus on evaluating the consequences of the technical work done by the subgroups/Task Teams and developing strategic recommendations to direct WGISS toward accomplishing its long-term goals. In 1998 and 1999, the Strategy Task Team met in WGISS meetings to develop further coordination with international organizations and promotional efforts as well as developing a concept paper for the way forward for WGISS. A new brochure (available in hard copy, PDF, or html) as well as a set of transparencies promoting WGISS activities will be presented to the 1999 CEOS Plenary.
- WGISS is actively seeking cooperation with other organizations such ISO/TC211, CCSDS, ISCGM, the Open GIS Consortium, and others.
- WGISS successfully participated in the CEOS exhibition associated with the UNI-

SPACE III conference in Vienna in July 1999, and promoted and distributed WGISS achievements such as CILS, the CEOS CD-ROM (Resources in Earth Observation) and the new WGISS brochure.

- WGISS has established a Home Page for CEOS (*http://www.ceos.org*) and for itself (*http://wgiss.ceos.org*) to promote information exchange and provide one-stop access to various advanced 'search and find' services for the CEOS community and beyond. The domain "CEOS.ORG" has been registered and used to make the CEOS home page easier to find and apply. The Network Subgroup of WGISS also supported the CEOS Secretariat in the registration of the IGOS Partnership Home Page: *http://www.igosparters.org*.

- CIP (Catalog Interoperability Protocol) definition was presented and endorsed at the 1998 Plenary and WGISS seeks support from CEOS member agencies in applying this work to their mission system planning.

- The GOIN Evolution Task Team (NAKODO) was established to meet the request from the GOIN Joint Planning Working Group through the CEOS Chairperson – for studying a future framework for GOIN (Global Observation Information Network) activities. The NAKODO Task Team studies a future framework for GOIN activities. The draft Task Team profile was presented and reviewed at the WGISS/Sub Group and GOIN joint meeting as well as at WGISS-9 in October. After 18 months of study, WGISS will present a recommendation to the CEOS Plenary in November, 2000, including the following items:

  a) how GOIN activities can be extended to the global community;
  b) how GOIN activities can be managed within CEOS or within a CEOS framework (if this is agreed to) or how to find a new home/framework for GOIN activities.

  A preliminary report and demo will be presented at the 1999 Plenary.

- The CEOS CD-ROM contains sample data, case studies, lesson plans, background text, glossaries, and points of contact for additional data and information, and links to relevant Internet resources. Building on the first version, developed by CSIRO, CNES developed further versions presented at the 1997 and 1998 Plenary meetings. CNES is soliciting contributions to expand the CD-ROM, with release of a further version planned for the 2000 Plenary.

- The CEOS Information Locator System (CILS) has begun the feasibility demonstration phase. CILS is a metadata information system that provides a network-based means for users in developing countries around the world to access information about Earth observation by satellite and gives users the opportunity to input, administer, and share their own relevant data and information.

- The CEOS Information Infrastructure (CII) task harmonizes information content across on-line CEOS information services, to take advantage of WWW technology to link the services in a manner which permits distributed responsibility for, and thus maximum efficiency of, maintenance of information content.

- The 1996 Plenary Demonstration project, Hazards and Emergency Response, CEOS InfoSys, as well as CEOS/IGBP High Resolution Satellite Data Projects were concluded by 1999.

WGISS SUBGROUPS

WGISS has three subgroups: Access, Data, and Network. Technical work within the subgroups is often performed in Task Teams.

Access Subgroup (AS)
The focus of the Access Subgroup is to enable Earth observation data and information services to be more accessible and usable to data providers and data users worldwide through international coordination. Developing international standards in Earth observation for catalogue systems and for achieving greater catalogue system interoperability are among the priorities.

The following Task Teams have been created to develop or demonstrate improved methods and tools for location, advertising, access and exchange of information:

- The International Directory Network (IDN) is an on-line data information service that provides free access to metadata directories of multidisciplinary information on scientific data held worldwide. Conversely, the IDN provides data holders with a means to advertise their data to the Earth Science community. See graphic representation at the end of this Chapter.

- The WWW Task Team investigates and coordinates the implementation of WWW access to international Earth observation catalogue systems and data access systems. This Task Team hosts annual workshops that focus on WWW developments as they relate to the access and utilization of Earth observation and related data. It works closely with the Data Subgroup.

- The CEOS Interoperability Extensions (CINTEX) builds on the results of the former CINTEX Task Team and the former Protocol Task Team. CINTEX maintains the CEOS Catalogue Interoperability Protocol (CIP) and provides federated management of CIP and IMS based interoperability.

- The Browse Task Team investigated the form of data browse products, the methods used to derive browse products from data, and the functionality of browse visualization tools. The Browse Guidelines Document was produced and is now available. This Task Team activity was closed and the document will be maintained under the Guidelines task.

- The Catalogue Guidelines Task Team maintained and developed the reference document, "Guidelines for an Internationally Interoperable Catalogue System." It has developed an on-line version of the Guidelines document. This Task Team activity will be continued in a framework of the Guidelines Task Team.

- The Protocol Task Team has been closed and will further be developed under the CINTEX. Also, the Yellow Pages Task was concluded and further will be developed by the CII.

Data Subgroup (DS)
The Data Subgroup enhances the complementarity, interoperability and standardization of Earth observation data and information management and services. It is undertaking tasks to foster the interuse of data, ensuring compatibility of data content, formats and tools used in the generation of data products.

The Data Subgroup currently maintains a number of Task Teams. The Data Subgroup Task Teams were extensively reorganized during 1999, with both the conclusion of some Tasks such as GLOBE and AVHRR 1-km (emerging under the new Global Datasets Tasks) and the evolution of some others (Format Guidelines, and Auxiliary Data Reference and Guide Task are within the new Guidelines Task. Data Interoperability Task is within the new Data Services Task).

- The Global Mapping and Visualization was renamed from the Global Mapping Task Team to expand its activities. The Task Team is concerned with map projections and new mapping schemes. It has three objectives: to recommend a standard global projection

scheme for global CEOS agency data sets; potentially to develop new data mapping and organization schemes which avoid the deficiencies of the current projections; and to endorse a set of standard navigational satellite geometry parameters, which would allow "mapping-on-demand" by the user. This Task Team will produce a reference manual on these issues.

- The Format Guidelines Task Team was concerned with digital data formats for CEOS member agency data products, generated and maintained a Format Guidelines Document, and identified sources of further information. This Task Team was merged into a newly established Guidelines Task Team, which will maintain existing guidelines related documents.

- The Archive Management Task Team reviews the entire process of primary satellite data capture at acquisition stations, ingestion into archives, maintenance of archives and aspects of perpetual data archiving. Among the objectives is to recommend a digital data standard for the direct storage of acquired data on digital media.

- The Global Datasets Task Team: Until recently, the Data Subgroup had several Task Teams specializing in various types of data sets. One of these was the GLOBE Task Team, which earlier this year released the most extensively designed, developed, reviewed and documented global elevation data set to date (see *http://www.ngdc.noaa.gov/seg/topo/globes.html*). In a recent reorganization, the Data Subgroup consolidated its work on global data sets into a single Global Datasets Task Team. Appropriate datasets would incorporate space-based data or technology (including image processing and related geographic information systems), or be useful for space missions.

- The Data Services Task Team provides a forum for developing a CEOS position related to the development of standards for interoperability that are currently under development. Its objective is to allow users to locate data, locate services, combine the services and data as desired by the user, resulting in data that is usable by a variety of software products. It works closely with the Access Subgroup.

- The Ocean Color Task was previously concluded and will be further developed under the framework of IGOS.

Network Subgroup (NS)

The primary objective of the Network Subgroup is to identify requirements, develop prototyping demonstrations, and help agencies improve network resources to support CEOS requirements. The WGISS Subgroups identify requirements to the Network Subgroup for networks to support CEOS tasks, projects and programs such as CINTEX, IDN and CIP. The Network Subgroup identifies network resources of the participating CEOS agencies and general Internet resources that can support those requirements. CEOS agencies carry out network performance measurements to measure the ability of identified network resources to support the requirements. Where increased performance is needed, the NS identifies network architecture and alternative network resources that can be used by agencies to implement increased network performance over those resources. The NS works to help agencies provide improved performance of networks over these resources to support the CEOS requirements.

The NS develops requirements for and helps agencies maintain the CEOSnet, which is a virtual private network supporting electronic exchange among CEOS agencies. The NS helps agencies develop the supporting documentation for the CEOSnet and provides a forum for discussion of network security issues and cooperation on security issues.

The NS helps agencies provide the information and prototyping experience needed to successfully transition CEOSnet Version 0 to a more robust

and much higher performance network. This Next Generation (NG) network must be capable of supporting the next generation of participating CEOS agency Earth observation missions and data production and access requirements.

The Network Subgroup carries out these activities through a number of Task Teams:

- The Network Resource Planning and Coordination Task Team was established to integrate the network resource planning and coordination and network architecture Task Teams. It helps agencies provide for the development of network capabilities to address CEOS objectives and requirements. The Task Team receives requirements for network support from the other CEOS Subgroups and activities and works with those Subgroups and their tasks, e.g., CINTEX, IDN, and CIP, to refine their requirements. The Task Team identifies current CEOS agency, Internet and other network resources that can potentially support the defined CEOS requirements. The Task Team help agencies configure a virtual CEOSnet, assesses the capability of the current CEOSnet architecture to meet CEOS objectives and requirements, develops recommendations and identifies opportunities for improving the ability of CEOSnet to address CEOS requirements.

- The Network Performance Measurement Task Team identifies network performance measurement tools available in the network community that provide the capability to measure and monitor the performance of network links, and applications over networks. The Task Team also sets up and maintains an ongoing network performance measurement program to assess available end-to-end network resources to support CEOS applications. The results of this measurement program are reported at CEOS Subgroup and WGISS meetings.

- The CEOSnet Next Generation (CEOSnet/ng) Prototyping Task Team provides a forum for coordinating CEOS agency activities in developing and prototyping their next generation architectures and networking technologies.

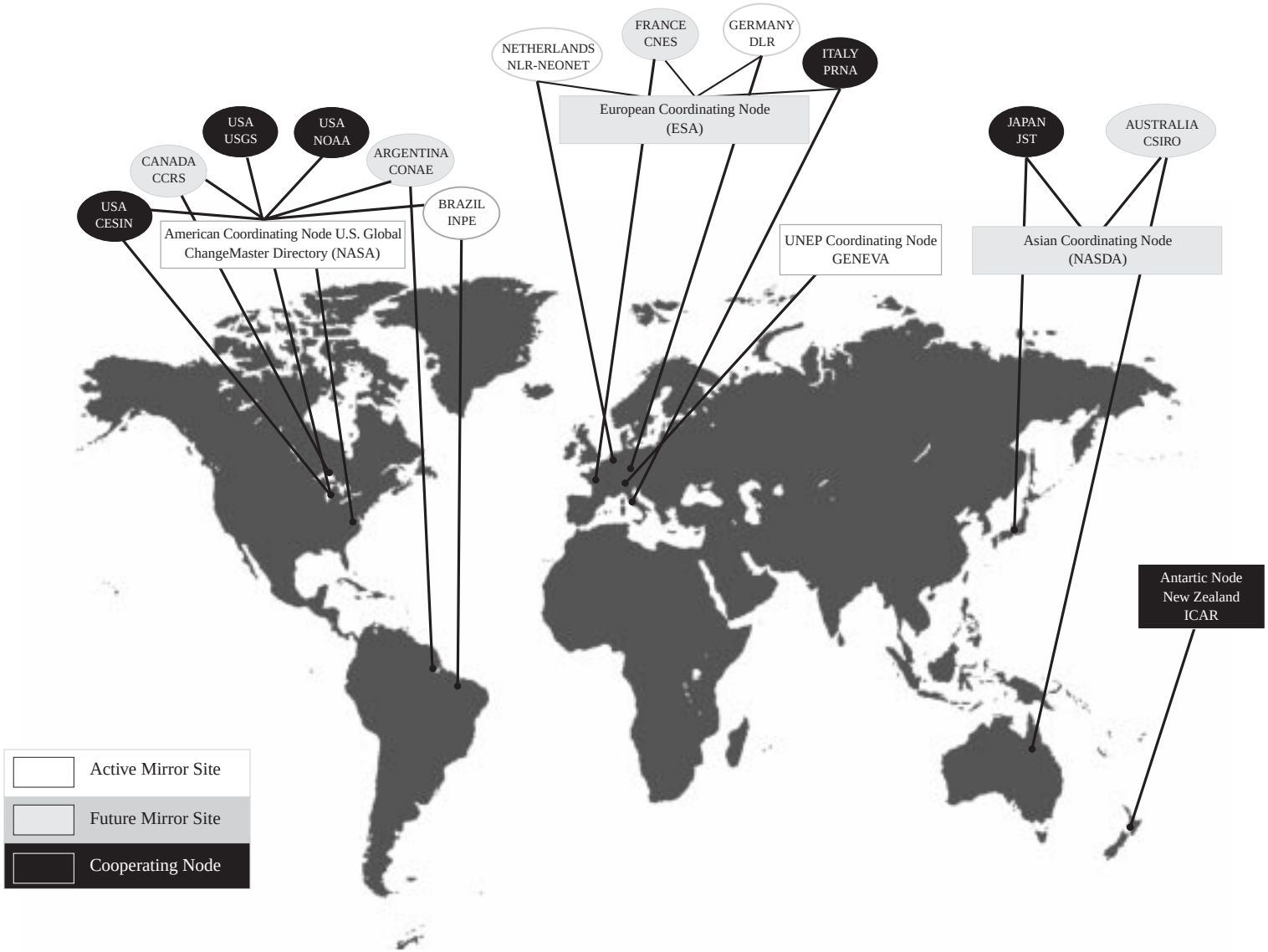
- The CEOS NS Security Task Team provides a forum for the discussion of security issues related to CEOSnet and participating CEOS agency network resources and the development of security capabilities to support those resources. It has generated the Acceptable Use Policy for CEOSnet and CEOSnet Security Policy.

LIST OF SIGNIFICANT WGISS DOCUMENTS

The following documents are available through WGISS (see Appendix A) or on-line at: *http://wgiss.ceos.org*.

- WGISS Newsletter
- Guidelines for an International Interoperable Catalogue System; Version 2.1, April 1993
- Catalogue Interoperability Protocol Specification; Release B, Version 2.2, March 1997
- Auxiliary Data in the CEOS Community Reference Guideline Document
- Guidelines on Standard Formats and Data Description Languages
- Standard CCT Format Family Requirements—CCB-CCT-0001B
- The Standard CCT Family of Tape Formats; Addendum for File Class Imagery Optional (IMOP)—CCB-CCT-0002E
- CEOSnet Security Policy
- CEOSnet Acceptable Use Policy
- Acceptable Use Policy for Subdomains of CEOS.ORG
- WGISS Brochure
- Browse Guidelines Document

IDN GRAPHIC


NETHERLANDS
NLR-NEONET
FRANCE
CNES
GERMANY
DLR
ITALY
PRNA
European Coordinating Node
(ESA)
USA
USGS
USA
NOAA
ARGENTINA
CONAE
CANADA
CCRS
USA
CESIN
BRAZIL
INPE
American Coordinating Node U.S. Global
ChangeMaster Directory (NASA)
UNEP Coordinating Node
GENEVA
JAPAN
JST
AUSTRALIA
CSIRO
Asian Coordinating Node
(NASDA)
Antartic Node
New Zealand
ICAR
Active Mirror Site
Future Mirror Site
Cooperating Node

CHAPTER 7: THE INTEGRATED GLOBAL OBESERVING STRATEGY (IGOS)

OVERVIEW OF THE IGOS CONCEPT

Since the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, which resulted in Agenda 21, an active process of structured coordination and synergistic convergence concerning global, regional and national efforts in environmental data collection, analysis and synthesis has increasingly gathered momentum. Independently, a number of substantial cooperative mechanisms were established in response to the Agenda 21 recommendations and requirements for better environmental information at national, regional and global levels. The Integrated Global Observing Strategy (IGOS) is one such effort.

IGOS intends to unite the major satellite and surface-based systems for global environmental observations of the atmosphere, oceans and land. It is a strategic planning process, involving many partners, that links research, long-term monitoring and operational programs, as well as data producers and users at technical and policy-making levels, in a framework that delivers maximum benefit and effectiveness.

IGOS focuses primarily on the observing dimension of the process of providing environmental information for decision-making. The strategy covers all forms of data collection concerning the physical, chemical and biological environments of the planet, as well as data on the human environment, on human pressures on the natural environment, and on environmental impacts on human well-being. It recognizes that data collection must be user driven, leading to information products that increase scientific understanding and guide early warning, policy setting and decision-making for sustainable development and environmental protection.

IGOS provides the framework that enables data suppliers to respond to requirements that have been set by users. It involves processes that determine deficiencies, identify resources to remedy such deficiencies, and improve not only the observational programs but also the various stages through which space- and ground-based observations are turned into useful information products. Finally the products and observations are monitored and analyzed to ensure they are fulfilling their goals.

The components of IGOS have considerable strategic importance, cutting across all observing activities. Major thrusts of IGOS, as it proceeds, will include: strengthening space-based and *in-situ* linkages to improve the balance between satellite remote sensing and ground- or ocean-based observing programs; encouraging the transition from research to operational environmental observations within appropriate institutional structures; improving data policies and facilitating data access and exchange; stimulating better archiving of data to build the long-term time series necessary to monitor environmental change; and increasing attention to harmonization, quality assurance and calibration/validation so that data can be used more effectively.

Lines of communication and dialogue are being established with the principal user groups and institutions to determine the needs for global environmental information for decision-making, including: international decision-making bodies such as the UN General Assembly, the Commission on Sustainable Development, and the conferences of parties to international and regional conventions; international organiza-

tions, convention secretariats, and international scientific advisory processes; national governments and their relevant ministries; decision-makers and senior advisors; the scientific community and international research programs; the private sector; non-governmental and public service organizations; the media, journalists, and others specialized in communications; the general public, grass-roots users and major groups.

THE IGOS PARTNERSHIP

The IGOS Partnership was established in 1998. The Partnership currently consists of CEOS, FAO, ICSU, UNEP, IOC-UNESCO, UNESCO, WMO, IGBP, WCRP, IGFA, GTOS, GCOS and GOOS. Moreover, it is open to new partners who are willing and able to commit to the implementation of IGOS. The IGOS Partnership has held three meetings to date; the Fourth meeting will be held in Stockholm in November 1999 in conjunction with the Thirteenth CEOS plenary Meeting.

IMPLEMENTATION OF IGOS THROUGH 'THEMES'

The IGOS Partnership is presently formulating its activities on the basis of a 'themes' concept. The set of six Pilot Projects initiated by CEOS in 1996 (see below) has proved useful in defining the IGOS concept, particularly its space component. However, the Partnership identified a danger in trying to implement IGOS solely through the continuation of projects, possibly leading to a patchwork coverage and not necessarily an integrated response on what is needed.

The 'themes' approach was first proposed by EUMETSAT to the CEOS Plenary and the IGOS Partnership meetings held in Bangalore, India, in November 1998. With a view toward broadening IGOS to include the observing activities of all Partners, the 'themes' concept was developed to provide a more coherent focus for the definition and implementation of IGOS. The fundamental underpinning of the theme approach is the acceptance that IGOS must establish priorities within broad theme areas; that the priorities must take account not only of the requirements of international programs but also those of national and regional programs and must be sensitive to major issues connected with international conventions; that IGOS must seek to exploit what already exists and to improve it incrementally; and that the definition and inclusion of *in-situ* requirements are vital to this process. At its Third meeting at FAO in Rome in June 1999, the IGOS Partnership endorsed the themes approach, and it is anticipated that the 1999 CEOS Plenary in Stockholm will do the same.

The Oceans Theme was identified as a pathfinder to demonstrate the concept and was recommended to move immediately into the implementation phase. NASA agreed to chair the Ocean Theme Team, which includes representatives from GOOS, CNES, ESA, ISRO, NASDA and NOAA. The Ocean Theme Team is preparing a revised interim report, which will be presented to the IGOS Partnership and CEOS Plenary meetings in November 1999.

The CEOS Strategic Implementation Team has encouraged themes to be developed in the areas of the carbon cycle and disaster management support. Other potential themes could include global net primary productivity, atmospheric chemistry and climate, coastal zones, terrestrial carbon cycle, climate impacts and climate variability/change, and the water cycle. Progress is being made on the development of a Carbon Cycle theme under the leadership of GTOS and FAO, in cooperation with the Chair of the joint GCOS/GTOS panel on Terrestrial Observations for Climate (TOPC). Following discussion at the TOPC meeting in Birmingham, UK in July 1999, internal meetings in FAO and electronic correspondence among a wide group of potential partners, a report is being prepared for the Fourth IGOS Partnership meeting in Stockholm. Progress is also being made on a Disaster Applications theme proposal under the

leadership of NOAA and the European Commission with cooperation from the FAO and UNESCO.

TRANSITION OF CEOS DEMONSTRATION PROJECTS TO IGOS THEMES

It is the intention of CEOS and the IGOS Partnership that the IGOS-related portions of the initial set of six concept demonstration projects endorsed by CEOS in 1996 be transitioned into the broader context of the IGOS Partnership. In this regard, the Global Ocean Data Assimilation Experiment and the Long Term Ocean Biology Measurements project have already transitioned as part of the pathfinder Oceans Theme. Moreover, the CEOS Strategic Implementation Team expects the following transitions for the IGOS-related elements of the remaining CEOS projects:

- The Global Observation of Forest Cover project will become part of an anticipated Carbon Cycle Theme;
- The Long-Term Continuity of Ozone Measurements project will transition as part of an anticipated Atmospheric Chemistry Theme;
- The Disaster Management Support project will be part of an anticipated Disaster Applications Theme; and
- The Upper Air Measurements project will transition to the WMO Open Program Area Group for Integrated Observing Systems.

HISTORY OF CEOS INVOLVEMENT IN THE DEVELOPMENT OF THE IGOS CONCEPT

Preliminary steps toward an IGOS were taken in connection with an environmental initiative undertaken by the UK Prime Minister in early 1992. At that time, an initial CEOS database of all existing and planned space-based Earth observation activities was developed by BNSC. This database, although rudimentary, did contain the first assessment of the extent to which requirements were being met and served as the source for a document which was produced and distributed at the UNCED meeting in Brazil in June 1992. Responsibility for the database of user needs now rests with WMO and the compilation of space observing system capabilities with ESA.

In Berlin at the 1994 Plenary, CEOS agreed to carry out a comprehensive analysis of the relation between space capabilities and user requirements and created an *ad hoc* Task Force on Planning and Analysis. From 1994 to 1996, several meetings were held involving participants from global environmental research and operational monitoring organizations, CEOS Members and Associates and addressed this issue. The Task Force completed its work in 1996. Based on this work, ESA and WMO jointly developed a database encompassing the user requirements and space observing system capabilities, which is now available on the Internet.

Spurred by the formulation of concepts in Japan and the United States, as well as within GCOS, for composite global observing systems that would integrate space-based and *in-situ* observations, the 1995 CEOS Plenary in Montreal organized a sidebar discussion to hear addresses by proponents of these various concepts, with EUMETSAT also making a presentation. CEOS then sponsored an *ad hoc* meeting in Seattle, Washington in March 1996. This definitive meeting charted a course for the development of the IGOS concept by CEOS. One of the key recommendations of the Seattle meeting was the creation of a study team, to be composed of Members and Associates, with a remit to plan a way forward, recognizing the key role that CEOS might play in a global strategy. In September 1996, a meeting sponsored by GCOS for the three Global Observing Systems was held to discuss the development of an IGOS for *in-situ* observations. One notable outcome of these meetings is that it became clear that the "S" in IGOS stood for a strategy not a system, in recognition of the fact that systems already exist and that IGOS would in reality be the virtual collection of existing and new systems.

When it concluded the work of the Task Force on Planning and Analysis, the 1996 CEOS Plenary in Canberra established two focused *ad hoc* groups with responsibility to progress CEOS' involvement in the development of the IGOS concept. The first group—the Strategic Implementation Team (SIT)—comprises CEOS Principals with the authority to commit agency support to initiatives as they unfold. The SIT was given the responsibility to define, characterize and develop a vision for CEOS' participation in IGOS; to set up prototypical projects to demonstrate the value of an integrated approach; to define responsibilities of the space component of an IGOS; and to address, with relevant partners, the interface between the space component and the *in-situ* component, in the context of user requirements with appropriate mechanisms for seamless integration. The SIT first met in Irvine, California in February of 1997, where six prototype Projects, deemed prototypical of the concept and principles behind IGOS, were endorsed:

- The Global Ocean Data Assimilation Experiment (GODAE);
- Upper Air Measurement project (UA);
- The Long-Term Continuity of Ozone Measurements projects;
- The Long Term Ocean Biology Measurement project;
- The Global Observations of Forest Cover project (GOFC); and
- The Disaster Management Support project (DMS).

The SIT has met five times and continues to define and coordinate CEOS Members' participation in the implementation of IGOS.

The second focused *ad hoc* group set up by the 1996 Plenary was the Analysis Group (AG). It was established to work closely with the SIT in taking forward the IGOS concept. The principal aim of the AG was to provide CEOS with an improved analysis of the extent to which the existing and planned space segment missions are meeting the identified international and national user requirements, as encapsulated in the CEOS and WMO databases. The AG met several times after its inception, and was disbanded by the 1997 CEOS Plenary in Toulouse, which deemed the AG had completed its chartered task.

1999 CEOS ACTIVITIES IN SUPPORT OF IGOS

CEOS continues to be actively involved in the implementation of IGOS. In 1999, the significant CEOS activities in this regard included:

- January 1999 meeting of the SIT;
- June 1999 meeting of the SIT;
- Participation in the IGOS Partnership Liaison Group, including the planning and conduct of IGOS Partnership meetings;
- Development and production of the IGOS Brochure (pdf version can be found at *http://nasda.ceos.org/igos_brochure.pdf*);
- Reservation of the URL for the Partnership: *http://www.igospartners.org*;
- Development of the *IGOS Bulletin* (first issue due out Autumn 1999);
- Active involvement in the preparation and conduct of the Technical Forum on IGOS as a parallel event during the UNISPACE III Conference in Vienna, July 1999. The final statement and recommendations of the IGOS Technical Forum can be found on the IGOS web site and below;
- Production of posters to be used at the joint CEOS/IGOS exhibit at UNISPACE III and staffing of the exhibit.

STATEMENT OF IGOS TECHNICAL FORUM AT UNISPACE III

Distr.: Limited
22 July 1999
Original: English

THIRD UNITED NATIONS CONFERENCE ON THE EXPLORATION AND PEACEFUL USES OF OUTER SPACE

Vienna
19-30 July 1999
Committee I
Agenda item 7
Status of the scientific knowledge of Earth and its environment

Technical Forum

Conclusions and proposals of the International Forum on the Integrated Global Observing Strategy: Into the Next Millennium

1. The Integrated Global Observing Strategy (IGOS) Partnership, established in 1998, links the major satellite- and surface-based systems for global environmental observations of the atmosphere, oceans, land and biota. IGOS is a strategic planning process, involving many partners, that combines research, long-term monitoring and operational programmes, as well as data producers and users, in a framework that delivers maximum benefit and effectiveness. It recognizes that data collection must be user-driven, leading to information products that increase scientific understanding and guide early warning, policy-setting and decision-making for sustainable development and environmental protection.

2. The complex global observing activities needed to understand and monitor Earth processes and to assess the impact of human activity require integration and cooperation at many levels. Such cooperation is imperative because of the impossibility for any single nation to equip itself to carry out all its necessary observations either because of the costs involved in space observations or the complexity of the logistic of many in situ observations. The need for collaboration between data providers also arises from the fact that contemporary data products often require the combination of multiple observations from multiple sources.

3. IGOS provides both a strategic framework and a planning process to bring together remotely sensed and in situ observations, from both research and operational programmes. Major thrusts of IGOS as it proceeds will include strengthening space-based and in situ linkages to improve the balance between satellite remote sensing and ground- or ocean-based observing programmes; encouraging the transition from research to operational environmental observations within appropriate institutional structures; improving data policies and facilitating data access and exchange; stimulating better archiving of and access to data to build the long-term time series necessary to monitor environmental change; and increasing attention to harmonization, quality assurance and calibration and validation so that data can be used more effectively. IGOS encourages the use of modular approaches to strategies for specific components or processes that need to be integrated and thematic approaches to particular categories or cross-cutting themes of observations such as oceans, disaster management and carbon storage and cycling.

4. Most environmental observations come from national activities, carried out by national Governments through agencies, ministries and research programmes, and their commitment is essential to the effective implementation of IGOS. The IGOS process promotes awareness of the benefits arising from integrated global observations in contributing to meeting the political objectives that have been set to improve the way the Earth is understood and managed. Moreover, IGOS can make a significant contribution to assisting national Governments and international organizations in implementing the international environmental conventions through both improved data and information access and quality of observations.

5. The Integrated Global Observing Strategy is implemented through an IGOS Partnership, including the Committee on Earth Observation Satellites (CEOS); the World Climate Research Programme and the International Geosphere-Biosphere Programme; the International Group of Funding Agencies for Global Change Research; the Food and Agriculture Organization of the United Nations; the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization (UNESCO); the International Council for Science; UNESCO; the United Nations Environment Programme; and the World Meteorological Organization; as well as the Global Climate Observing System; the Global Ocean Observing System; and the Global Terrestrial Observing System. The Partnership provides a continuing mechanism to oversee the IGOS process, with meetings arranged among the partners twice a year in association with the plenary sessions of CEOS and meetings of the Sponsors Group for the Global Observing Systems. New partners willing to contribute to the implementation of IGOS can be added.

6. Participants in the Technical Forum on IGOS were briefed on the status of the development of IGOS and the creation of the IGOS Partnership. Participants underscored the relevance of IGOS to many of the themes of the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) and encouraged the continued implementation of IGOS. In particular, support was voiced for the role of IGOS in:

(a) Enhancing international cooperation in general and between data providers, users and policy makers in particular;

(b) Promoting more effective means of using space-based data in addressing practical prolems and environmental issues of local, regional and global significance;

(c) Capacity-building in the area of Earth observation and global environmental monitoring, especially in developing countries.

7. The main recommendations of the Forum are as follows:

(a) The efforts of the IGOS Partnership to achieve a coherent articulation of the requirements for data from Earth observing systems and to stimulate the coordinated development and integration of remote sensing and in situ data collection systems should be supported. This is an essential process to combine current and planned space capabilities with those on the ground and in the oceans, and should involve international bodies and national agencies and organizations, including industry;

(b) The rapid improvement in the quality, frequency and resolution of satellite data acquisition must be matched by a comparable strengthening of the complementary surface observation and ground "truthing" activities;

(c) The reinforcement of a full range of data collection programmes and of the institutional structures for processing, archiving, integrating and assessing environmental data from all sources is essential to build the reliable long-term time series of data necessary for global change research on critical environmental problems;

(d) Special attention should be given to strengthening the research, operational, data collection and analysis and application capacities of developing countries to fill critical gaps in global data sets and their utilization to improve local knowledge of changes in and pressures on environmental resources;

(e) As observing systems for environmental data collection prove their usefulness, Governments should support the transition from research and development programmes to operational environmental observing programmes with appropriate institutional arrangements and budgetary support;

(f) The systematic assessment of user needs and of the ability of satellite instruments to meet those needs should be continued and extended. Commitments will be needed from space agencies to meet the resulting requirements and also from users to maximize the use of satellite-derived inputs in their modelling and decision-making processes.

CHAPTER 8: DEVELOPING COUNTRY ACTIVITIES

CEOS STRATEGY

The CEOS Strategy toward Developing Countries states:

> "The fundamental aim of CEOS in its developing country activities is to encourage the creation and maintenance of indigenous capability that is integrated into the local decision-making process, thereby enabling developing countries to obtain the maximum benefit from Earth observation.
>
> CEOS agencies are urged to use their influence, both within the framework of CEOS and in their own individual activities, to ensure that efforts are maintained in support of developing countries, and indeed increased wherever practicable. In addition, CEOS Working Groups are advised to pay special attention to developing country initiatives, and coordination of these initiatives among the Associates and with aid-to-development organizations is encouraged."

The 1994 Plenary in Berlin formally adopted this strategy, which was developed at an INPE-hosted workshop earlier in the year. General technical areas for cooperative activities in support of developing countries which CEOS agencies can promote have been identified as:

- assessment of space capabilities versus user requirements;
- data access, ground structures, information services;
- assessment of data use, analysis of lessons from the past;
- promotion of well-designed pilot projects, including user involvement;
- increased education and training;
- growth of local talent;
- provision of infrastructures suited to local operational conditions; and
- improved use of existing user interfaces, with augmentation if necessary.

Specifically, CEOS agencies are implementing the following recommendations from the Eighth Plenary:

- Links should be established between CEOS and developing countries, both directly and through non-CEOS organizations.
- Communication should be facilitated among CEOS participants regarding developing country activities.
- CEOS interest in supporting activities with developing countries should be made widely known.
- CEOS will work with relevant development assistance agencies to identify mechanisms that would facilitate access to satellite data for developing country activities.
- CEOS will contribute to UN-related training programs and the proposed Centers on Space Science and Technology Education.

- The inclusion of developing country scientists in CEOS agencies' visiting scientist programs will be encouraged.

- Identification of and support for global change research test sites and planned airborne campaigns to facilitate coordination of individual agency plans.

- CEOS Secretariat and Chairperson will ensure that time is devoted at each Plenary session to developing country issues. Within their fields of activity, the Working Groups are urged to give particular attention to the special requirements of developing countries.

CEOS ACTIVITIES IN SUPPORT OF DEVELOPING COUNTRIES

- The Information Locator Service (CILS) for developing countries was debuted at the Eleventh Plenary in 1997. Its development has been spearheaded by DLR since 1994. CILS is a prototype electronic information service designed primarily to meet the requirements of users of Earth observation and remote sensing data in developing countries. CILS provides network-based means for users in developing countries to access information about satellite Earth observation and enables them to enter, administer and share their data and information. CILS also contains information of special interest to developing countries and provide relevant points of contact. Several other CEOS agencies also host CILS sites.

- The first CEOS Report on developing countries initiatives was issued in 1997. An initiative of EUMETSAT, the Report is one implementation of the CEOS Strategy toward Developing Countries. Primarily a vehicle to exchange views and information among participating CEOS agencies, the Report is expected to promote discussion on the implementation of the CEOS strategy and its relevance to drive practical actions. It will also help in identifying opportunities for new CEOS initiatives with developing countries.

- CEOS has released several editions of its CD-ROM, entitled "Resources in Earth Observation: Case Studies, Data and Information for Schools and Developing Countries." The CD-ROM is intended for use primarily by developing countries and educators. The first edition was pioneered in 1996 by CSIRO; the 1997 release integrates nearly 50 percent more information and was issued by CNES; the next release is anticipated in 2000. It is available from the CEOS Secretariat or on-line at *http://www-projet.cnes.fr/ceos/cdrom-97/*. The CD-ROM contains data and information provided by participating CEOS agencies. The CD-ROM has three primary objectives:
  — to help meet unsatisfied needs in developing countries for information about Earth observation applications, data sources, and future plans;
  — to help teachers and students around the world learn through observations from space;
  — to strengthen worldwide understanding of the social benefits of Earth observation by satellites and of the efforts of international organizations such as CEOS which attempt to make these benefits both widespread and equitably shared.

CHAPTER 9: FLIGHT AND GROUND SEGMENT PROGRAMS OF CEOS AGENCIES

This section lists space- and ground-based assets included within the scope of CEOS Members' and Associates' activities. Some of the cooperative arrangements associated with these programs resulted from information exchanged under CEOS auspices. In all cases, an effort is being made to use the recommendations of the CEOS WGISS and WGCV, where appropriate, for data exchange formats and calibration and validation activities.

This listing represents current information, provided by the agencies themselves, as of October 1, 1999. Please refer to agency home pages, listed in Appendix B, for updates or additional information on specific programs.

MEMBERS

AGENZIA SPAZIALE ITALIANO (ASI)

- LAGEOS-2—October 1992 (with NASA)

Also Contributing To:
SRL—April 1994, September 1994 (with DLR, NASA)
Vegetation on SPOT-4—March 1998 (with CNES, EC, SNSB, OSTC)
SRTM – 1999 (with DLR, NASA)

BRITISH NATIONAL SPACE CENTRE (BNSC)

Contributing To:
NOAA-10 through -12; -14 through -15; -L through -M—1986-2001 (with NOAA, CSA, CNES)
ERS-1—July 1991 (with ESA, CNES, DLR, OSTC)
UARS—September 1991 (with NASA, CSA, CNES)
ERS-2—April 1995 (with ESA, CNES, DLR, OSTC)
ENVISAT—2000 (with ESA, CNES, DLR, SNSB, OSTC)
MSG Series—2000, 2002, 2006 (with EUMETSAT, ESA, SNSB)
EOS CHEM—December 2002 (with NASA, Netherlands)
European Polar System (EPS) beginning with METOP-1—2003 (with EUMETSAT, ESA, CNES, NOAA, SNSB)
CHRIS (on PROBA) – 2000 (with ESA, OSTC)

CANADIAN SPACE AGENCY (CSA)

- Radarsat-1—November 1995 (with NASA, NOAA, CCRS)
- Radarsat-2 —2002 (with CCRS)
- SCISAT—December 2001 (with NASA)

Also Contributing To:
UARS —September 1991 (with NASA, BNSC, CNES)
ODIN—1999 (with SNSB, CNES, Finland)
EOS-AM (Terra)—NET November 1999 (with NASA)
NOAA-10 through -12; -14 through -15; -L through -M—1986-2001 (with NOAA, BNSC, CNES)
CloudSat – March 2003 (with NASA)

CENTRE NATIONAL D'ETUDES SPATIALES (CNES)

- SPOT-1 through -4—1986, 1990, 1993, 1998 (with SNSB, OSTC)
- TOPEX/Poseidon—August 1992 (with NASA)
- STELLA—September 1993
- ScaRaB on Meteor — January 1994 (with Rosaviakosmos, DLR)
- Vegetation (on SPOT-4)—March 1998 (with EC, ASI, SNSB, OSTC)
- ScaRaB on Resurs-01 (N4) — July 1998 (with Rosaviakosmos, DLR)
- Jason-1— May 2000 (with NASA)
- POLDER on ADEOS-2 — 2000 (with STA/NASDA, NASA, NOAA)
- Vegetation 2 (on SPOT-5)—2001 (with SNSB, OSTC)
- IASI on METOP-1 – 2003 (with EUMETSAT, SNBC)
- PICASSO-CENA – 2003 (with NASA)

Also Contributing To:
ERS-1—July 1991 (with ESA, DLR, BNSC, OSTC, SNSB)
UARS —September 1991 (with NASA, BNSC, CSA)
ATLAS-1, -2, -3—1992, 1993, 1994 (NASA, DLR, OSTC)
ERS-2—April 1995 (ESA, DLR, BNSC, OSTC, SNSB)
OERSTED – February 1998 (with Denmark, NASA)
NOAA-10 through -12; -14 through -15; -L through -M—1986-2001 (with NOAA, CSA, EUMETSAT/BNSC)
ODIN—1999 (with SNSB, CSA, Finland)
ENVISAT—May 2000 (with ESA, BNSC, DLR, OSTC, SNSB)
CHAMP—March 2000 (with NASA, DLR)
European Polar System (EPS) beginning with METOP-1—2003 (with EUMETSAT, ESA, NOAA, BNSC, SNSB)

CHINESE ACADEMY OF SPACE TECHNOLOGY (CAST)

- FY-2—June 1997 (with NRSCC)
- FY1C—1998 (with NRSCC)
- CBERS-1—NET October 1999 (with INPE)
- CBERS-2—2001 (with INPE)
- FY-1D—2000 (with NRSCC)

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO)

- Earth Observation Center data archive

- Nodes for CILS, international networks and ground sites
- ARIES-1—2000 (with ARIES Consortium)
- FedSat-1—November 2000 (with Cooperative Research Centre for Satellite Systems)

Also Contributing To:
AATSR on ENVISAT (with BNSC)
Tasmanian Earth Resources Satellite System (as part of TERSS consortium)
Western Australian Satellite Technology and Applications Centre (as part of WASTAC consortium)

DEUTSCHES ZENTRUM FÜR LUFT- UND RAUMFAHRT (DLR)

- SRL-1, -2—April 1994, September 1994 (with NASA, ASI)
- CRISTA-SPAS-1, -2—November 1994, August 1997 (with NASA)
- SRTM—NET January 2000 (with NASA)
- CHAMP—2000 (with NASA, CNES)
- BIRD – late 2000
- GRACE—July 2001 (with NASA)

Also Contributing To:
ERS-1—July 1991 (with ESA, CNES, BNSC, OSTC, SNSB)
ATLAS-1, -2, -3—1992, 1993, 1994 (with NASA, CNES, OSTC)
ScaRaB on Meteor — January 1994 (with Rosaviakosmos, CNES)
ERS-2—April 1995 (with ESA, BNSC, CNES, OSTC, SNSB)
IRS-P3—March 1996 (with ISRO)
PRIRODA—April 1996 (with Rosaviakosmos, NASA)
ScaRaB on Resurs-01 (N4) — July 1998 (with CNES, Rosaviakosmos)
ENVISAT—2000 (with ESA, CNES, BNSC, OSTC, SNSB)

EUROPEAN SPACE AGENCY (ESA)

- ERS-1—July 1991
- ERS-2—April 1995
- ENVISAT—2000 (with BNSC, CNES, DLR, SNSB, OSTC)
- MSG-1—2000 (with EUMETSAT, BNSC, SNSB)
- The Living Planet Program (Earth Explorers and Earth Watch) starting with Earth Explorer Opportunity Mission—2002
- European Polar System (EPS) beginning with METOP-1—2003 (with EUMETSAT, NOAA, CNES, ESA, SNSB)
- EARTHNET—Ongoing
- PROBA—2000 (with BNSC, OSTC)

EUROPEAN COMMISSION (EC)

Contributing To:
Vegetation on SPOT-4—March 1998 (with CNES, OSTC, SNSB, ASI)

EUROPEAN ORGANISATION FOR THE EXPLOITATION OF METEOROLOGICAL SATELLITES (EUMETSAT)

- Meteosat-3 through -7—1988 (with ESA), 1989, 1991, 1993, and 1997
- MSG Series—2000, 2002, 2006 (with ESA, BNSC, SNSB)
- European Polar System (EPS) beginning with METOP-1—2003 (with ESA, CNES, NOAA, BNSC, SNSB)

Also Contributing To:
NOAA-N—2003 (with NOAA, CNES, CSA)

INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS (INPE)

- MECB

– Data Collecting Satellite-1—February 1993
– Data Collecting Satellite-2—October 1998
– Remote Sensing Satellite-1—2003
– Data Collecting Satellite-3—2004
– Remote Sensing Satellite-2—2006

- CBERS-1—NET October 1999 (with CAST)
- CBERS-2—2001 (with CAST)

Also Contributing To:
EOS-PM-1—2000 (with NASA, STA/NASDA)
CIMEX—2002 (with NASA)

INDIAN SPACE RESEARCH ORGANISATION (ISRO)

- IRS-1A—March 1988
- IRS-1B—August 1991
- INSAT-2A—July 1992
- INSAT-2B—July 1993
- IRS-P2—October 1994
- IRS-1C—December 1995
- IRS-P3—March 1996 (with DLR)
- IRS-1D— September 1997
- INSAT-2E—April 1999
- IRS-P4 (OCEANSAT 1)—May 1999
- IRS-P5 (CARTOSAT 1) —2000
- IRS-P6 (RESOURCESAT 1)—2001

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

- UARS—September 1991 (with BNSC, CSA, CNES)
- ATLAS-1, -2, -3—1992, April 1993, November 1994 (with DLR, CNES, OSTC)
- TOPEX/Poseidon—August 1992 (with CNES)
- SRL-1, -2—April 1994, September 1994 (with DLR, ASI)

- TOMS/Earth Probe—July 1996
- SeaStar (SeaWiFS)/OrbView-2—August 1997
- SSBUV—Present through 1997
- TRMM—November 1997 (with STA/NASDA)
- Landsat-7—April 1999 (with USGS)
- QuickSCAT (SeaWinds)— June 1999
- SRTM— NET January 2000 (with DLR)
- EOS-AM-1 (Terra)— NET November 1999 (with CSA, MITI)
- SAGE III on Meteor-3M— 2000 (with Rosaviakosmos, ROSHYDROMET)
- Jason-1—May 2000 (with CNES)
- VCL – August 2000
- QuikTOMS – August 2000
- EOS-PM-1—December 2000 (with NASDA, INPE)
- Triana – December 2000
- SeaWinds on ADEOS-2—December 2000 (with STA/NASDA, CNES, NOAA)
- GRACE — June 2001 (with DLR)
- ICESat – July 2001
- SCISAT – December 2001 (with CSA)
- CIMEX – April 2002 (with INPE)
- SORCE – July 2002
- SAGE III on International Space Station – October 2002
- EOS CHEM—December 2002 (with BNSC, Netherlands)
- PICASSO-CENA – March 2003 (with CNES)
- CloudSat – March 2003 (with CSA)
- EO-3—March 2003
- TDRSS—Ongoing
- EOSDIS—Ongoing

Also Contributing To:
LAGEOS-2—October 1992 (with ASI)
Radarsat-1 —November 1995 (with CSA, NOAA)
CRISTA-SPAS-1, -2—November 1994, August 1997 (with DLR)
PRIRODA—April 1996 (with RASA, DLR)
Sunsat – February 1999 (with South Africa)
Oersted – February 1999 (with Denmark)
GOES-L – NET October 1999 (with NOAA)
CHAMP—2000 (with DLR, CNES)
NOAA-L POES – February 2000 (with NOAA)
NOAA-M – 2001 (with NOAA)
GOES-M – 2002 (with NOAA)
GOES-N – 2002 (with NOAA)
METOP-1 – 2003 (with EUMETSAT, BNSC, CNES, ESA, NOAA, SNSB)
NOAA-N – 2003 (with NOAA, CNES, CSA, EUMETSAT)

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

- Landsat-5—March 1984 (with NASA)
- NOAA-10 through -12; 14-15; -L through -M—1986-2001 (with CSA, CNES, EUMETSAT/BNSC)
- GOES-8—April 1994
- GOES-9—May 1995
- GOES-10— April 1997
- GOES-L—NET October 1999 (with NASA)
- GOES-M—2001 (with NASA)
- GOES-N — 2002 (with NASA)
- GOES-O — 2005
- GOES-P — 2007
- GOES-Q —2010
- NOAA-N—2003 (with CNES, CSA, EUMETSAT, NASA)
- First NPOESS—2008
- NOAA-N'—2008 (with CNES, CSA, EUMETSAT)

Also Contributing To:
Radarsat-1—November 1995 (with CSA, NASA)
ADEOS-2—December 2000 (with STA/NASDA, NASA CNES)
European Polar System (EPS) beginning with METOP-1—2003 (with EUMETSAT, ESA, CNES, BNSC, SNSB)

NATIONAL REMOTE SENSING CENTER OF CHINA (NRSCC)

- FY-2—June 1997 (with CAST)
- FY-1C—1998 (with CAST)
- FY-1D—2000 (with CAST)

NATIONAL SPACE AGENCY OF UKRAINE (NSAU)

- OKEAN-01 (N7)—1994 (with RASA and ROSHYDROMET)
- SICH-1 [OKEAN-01 (N8)]—August 1995 (with RASA)
- OKEAN-O—July 1999 (with RASA and ROSHYDROMET)
- SICH-1M—2000
- SICH-2—TBD

RUSSIAN AVIATION AND SPACE AGENCY (ROSAVIAKOSMOS)/ RUSSIAN FEDERAL SERVICE FOR HYDROMETEOROLOGY AND ENVIRONMENTAL MONITORING (ROSHYDROMET)

- Meteor-2 (N21)—August 1993
- Meteor-3 (N5)—January 1994
- OKEAN-01 (N7)—October 1994
- GOMS/Electro (N1)—October 1994
- Resurs-01 (N3)—November 1994

- OKEAN-01 (N8) [SICH-1]—August 1995 (with NSAU)
- Resurs-F—September 1995
- PRIRODA—April 1996 (with NASA, DLR)
- Resurs-F1 (M)—November 1997
- Resurs-01 (N4)— July 1998 (with CNES, DLR)
- OKEAN-O—July 1999 (with NSAU)
- Resurs-F1M—September 1999
- Meteor-3M (N1)— March 2000 (with NASA)
- GOMS/Elektro (N2)—2001
- Resurs DK—2001
- Meteor-3M (N2) —2002
- Resurs-01 (N5)—2003

SWEDISH NATIONAL SPACE BOARD (SNSB)

- ERS Main Station (under contract to ESA)—Ongoing
- Landsat Station (under contract to ESA)—Ongoing
- SPOT Main Station—Ongoing
- Kiruna Ground Station—Ongoing
- Vegetation Receiving Station—Ongoing
- ODIN—1999 (with CSA, CNES and Finland)
- ENVISAT Main Station (under contract to ESA)—2000

Also Contributing To:
SPOT-1 through -4—1986, 1990, 1993, 1998 (with CNES, OSTC)
Vegetation (on SPOT-4)—March 1998 (with CNES, EC, OSTC, ASI)
SPOT-5 — 2001 (with CNES, OSTC)
Vegetation (on SPOT-5) – 2001 (with CNES, OSTC)
ERS-1 – July 1991 (with ESA, CNES, DLR, OSTC)
ERS-2 – April 1995 (with ESA, CNES, DLR, OSTC)
ENVISAT – 2000 (with ESA, CNES, DLR, OSTC)
MSG-1 – 2000, 2002, 2006 (with EUMETSAT, ESA, BNSC)
European Polar System (EPS) beginning with METOP-1 – 2003 (with EUMETSAT, ESA, BNSC, CNES, NOAA)
The Living Planet Program (Earth Explorer and Earth Watch) starting with Earth Explorer Opportunity Mission – 2002 (with ESA)

SCIENCE AND TECHNOLOGY AGENCY (STA)/ NATIONAL SPACE DEVELOPMENT AGENCY OF JAPAN (NASDA)

- GMS-4—September 1989 (with JMA)
- JERS-1—February 1992
- GMS-5—March 1995 (with JMA)
- TRMM—November 1997 (with NASA)
- MTSAT— September 1999 (with MOT)
- ADEOS-2—November 2000 (with CNES, NASA, NOAA)

- ALOS—2002
- MDS/ELISE – 2003
- JEM/SMILES
- ATMOS-A1
- GCOM-A1 – 2005
- GCOM-B1 – 2005

Also Contributing To:
EOS-PM-1—2000 (with NASA, INPE)
FedSat —November 2000 (with CSIRO, NASA)

ASSOCIATES
Canada Centre for Remote Sensing (CCRS)
- Gatineau and Prince Albert Satellite Receiving Stations – Ongoing
- Landsat, SPOT, ERS, RADARSAT, NOAA AVHRR reception and archiving – Ongoing
- RADARSAT International (RSI), SPOT and Landsat Processing Facility and Distribution Arrangement – Ongoing
- Co-location or RSI RADARSAT Processing Facility at Gatineau Satellite Station – Ongoing
- RADARSAT Precision Transponder operations – Ongoing
- ERS SAR processing facility – Ongoing
- ERS LBR reception and processing (under contract to ESA) – Ongoing

Also contributing to:
Radarsat-1 (with CSA, NASA) – Ongoing
Radarsat-2 (with CSA) – 2002

FEDERAL OFFICE FOR SCIENTIFIC, TECHNICAL AND CULTURAL AFFAIRS (OSTC) OF BELGIUM

- Vegetation Processing Station—1998
- PROBA – 2000 (with ESA, BNSC)

Also Contributing To:
ERS-1—1991 (with ESA,CNES, DLR, SNSB, OSTC)
ATLAS—1992, 1993, 1994 (with NASA, CNES, DLR)
ERS-2—1995 (with ESA, SNSB)
SPOT-1 through -4 —1986, 1990, 1993, 1998 (with CNES, SNSB)
Vegetation - 1 (on SPOT-4)—March 1998 (with CNES, EC, SNSB, ASI)
ENVISAT – 2000 (with ESA, CNES, DLR, SNSB)
Vegetation-2 (on SPOT-5) – 2001 (with CNES, SNSB)
SCIAMACHY (on ENVISAT)—2000 (with DLR)
METEOSAT, MSG, METOP series (with ESA, EUMETSAT)
GERB (on MSG) – starting 2000 (with BNSC, ASI, ESA, EUMETSAT)

NORWEGIAN SPACE CENTER (NSC)

- Tromsø Satellite Station—Ongoing

- ERS, NOAA satellites and Orbview-2 Station (under contract to ESA) – Ongoing
- Svalbard Satellite Station—Ongoing
- Landsat-7 and QuikSCAT Station (under contract to NASA) — Ongoing
- Terra (EOS-AM-1) Station (under contract to NASA)—1999

SATELLITE APPLICATIONS CENTRE (SAC)/SOUTH AFRICAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH (CSIR)

- Hartebeesthoek Satellite Station (HBK) Tracking Telemetry and Command (TT&C) services - ongoing
- SPOT-2 reception and archiving (Dali catalogue updates to SPOT IMAGE) – ongoing since June 1991
- SPOT-4 reception and archiving (Dali catalogue updates to SPOT IMAGE) – ongoing since June1999
- Landsat-5 reception and archiving – ongoing since June 1989
- ERS-2 reception and archiving – ongoing since January 1994
- NOAA AVHRR reception and archiving - ongoing since November 1984
- OrbView-2 reception and archiving - ongoing since June 1998
- Radarsat International (RSI) Distributor – ongoing since 1996

Also Contributing to:
HBK Orbital Services in support of SPOT-1, -2, -4 and Helios– ongoing (with CNES)

APPENDIX A: CEOS REPRESENTATIVES AND CONTACT INFORMATION

CEOS PLENARY PRINCIPALS AND POINTS-OF-CONTACT

MEMBERS

Agenzia Spaziale Italiano (ASI)
Prof. Massimo Trella (Principal)
Mr. Giovanni Rum (Contact)

British National Space Centre (BNSC)
Dr. Colin Hicks (Principal)
Dr. Stephen Briggs (Contact)

Chinese Academy of Space Technology (CAST)
Prof. Xu Fuwiang (Principal)
Prof. Yan Weiyuan (Contact)

Centre National d'Etudes Spatiales (CNES)
Mr. Gerard Brachet (Principal)
Mr. Jean-Louis Fellous (Contact)

Canadian Space Agency (CSA)
Dr. Virendra Jha (Principal)
Dr. Virendra Jha (Contact)

Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Dr. Graham Harris (Principal)
Dr. David Jupp (Contact)

Deutsches Zentrum für Luft- und Raumfahrt (DLR)
Prof. Achim Bachim (Principal)
Dr. Volker Liebig (Contact)

European Commission (EC)
Mr. Christian Patermann (Principal)
Dr. Anver Ghazi (Contact)

European Space Agency (ESA)
Prof. David Southwood (Principal)
Prof. David Southwood (Contact)

European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) — *1999 Chair*
Dr. Tillmann Mohr (Principal)
Dr. David Williams (Contact)

Instituto Nacional de Pesquisas Espaciais (INPE) — *2000 Chair*
Mr. Marcio N. Barbosa (Principal)
Dr. Mary Toshie Kayano (Contact)

Indian Space Research Organisation (ISRO) — *1998 Chair*
Dr. Krishnaswamy Kasturirangan (Principal)
Mr. V.J. Jayaraman (Contact)

National Aeronautics and Space Administration (NASA)
Dr. Ghassem Asrar (Principal)
Ms. Leslie Charles (Contact)

National Oceanic and Atmospheric Administration (NOAA)
Mr. Gregory Withee (Principal)
Dr. Brent Smith (Contact)

National Remote Sensing Center of China (NRSCC)
Prof. Lin Quan (Principal)
Mr. Cao Hongjie (Contact)

National Space Agency of Ukraine (NSAU)
Dr. Valery Kanevsky (Principal)
Mr. Victor Zubko (Contact)

Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)/Planeta
Prof. Sergei I. Avdiushin (Principal)
Dr. Elena Manaenkova (Contact)

Russian Aviation and Space Agency (Rosaviakosmos)
Prof. Georgy M. Polyschuk (Principal)
Dr. Sergei Kulik (Contact)

Swedish National Space Board (SNSB)
Mr. Per Tegner (Principal)
Dr. Marianne Treschow (Contact)

Science and Technology Agency (STA)/National Space Development Agency (NASDA) of Japan
Mr. Yuji Sakakibara (Principal)
Mr. Chu Ishida (Contact)

ASSOCIATES

Canada Centre for Remote Sensing (CCRS)
Dr. Ed Shaw (Principal)
Mr. Tom Feehan (Contact)

Crown Research Institute (CRI) of New Zealand
Dr. Andy Pearce (Principal)
Ms. Stella Belliss (Contact)

Federal Office for Scientific, Technical, and Cultural Affairs (OSTC) of Belgium
Mr. Michel Verbauwhede (Principal)
Mr. Eric Beka (Contact)

Global Climate Observing System (GCOS)
Dr. Kirk Dawson (Principal)
GCOS Secretariat (Contact)

Global Ocean Observing System (GOOS)
Dr. Angus McEwen (Principal)
Dr. Colin Summerhayes (Contact)

Global Terrestrial Observing System (GTOS)
Dr. Michael Glantz (Principal)
Mr. Jeff Tschirley (Contact)

International Council of Scientific Unions (ICSU)
Dr. Larry Kohler (Principal)
Ms. Anne Larigauderie (Contact)

International Geosphere-Biosphere Program (IGBP)
Dr. G. Szejwach (Principal)
Dr. G. Szejwach (Contact)

Intergovernmental Oceanographic Commission (IOC)
Dr. P. Bernal (Principal)
Dr. P. Bernal (Contact)

International Society on Photogrammetry and Remote Sensing (ISPRS)
Mr. Lawrence Fritz (Principal)
Mr. Lawrence Fritz (Contact)

Norwegian Space Center (NSC)
Mr. Rolf Skår (Principal)
Mr. Per Erik Skrovseth (Contact)

Satellite Applications Centre (SAC)/South African Council for Scientific and Industrial Research (CSIR)
Mr. Renier Balt (Principal)
Mr. Piet van e Westhuizen (Contact)

United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)
Dr. Adrianus Mooy (Principal)
Dr. She Guangong (Contact)

United Nations Environment Program (UNEP)
Dr. Arthur Dahl (Principal)
Mr. Mick Wilson (Contact)

United Nations Food and Agriculture Organization (FAO)
Mr. He Changchui (Principal)
Mr. Jelle U. Hielkema (Contact)

United Nations Office for Outer Space Affairs (UNOOSA)
Mr. Nandi Jasentuliyana (Principal)
Mr. Adigun Ade Abiodun (Contact)

World Climate Research Programme (WCRP)
Dr. Harmut Grassl (Principal)
Dr. Hans Teunissen (Contact)

World Meteorological Organization (WMO)
Mr. Robert Landis (Principal)
Dr. Donald E. Hinsman (Contact)

CEOS SECRETARIAT

PERMANENT AGENCIES

Europe/Africa

Dr. Harald Arend
European Space Agency
8-10, rue Mario Nikis
75738 Paris Cedex 15
France
+33-1-53-69-75-50 (voice)
+33-1-53-69-77-35 (fax)
harend@hq.esa.fr

Japan/Asia/Pacific Rim

Mr. Chu Ishida
Earth Observation Planning Department
Office of Earth Observation Systems
National Space Development Agency of Japan
2-4-1, Hamamatsu-cho, Minato-ku
Tokyo 105-8060

Japan
+81-3-3438-6318 (voice)
+81-3-5401-8702 (fax)
Ishida.Chu@nasda.go.jp
ceosj@eoc.nasda.go.jp

United States/ North & South America

Ms. Leslie Charles
NASA Headquarters – Code IY
300 E Street, SW
Washington, DC 20546
USA
+1-202-358-0793 (voice)
+1-202-358-2798 (fax)
leslie.charles@hq.nasa.gov

Dr. Brent Smith
NOAA/NESDIS
E/IA, SSMC3, Room 3620
1315 East West Highway
Silver Spring, Maryland 20910-3282
USA
+1-301-713-2024 (voice)
+1-301-713-2032 (fax)
brent.smith@noaa.gov

CEOS CHAIR REPRESENTATION (ROTATES ANNUALLY)

1999 Chair Rep (Current)

Dr. David Williams
European Organisation for the Exploitation of Meteorological Satellites
Am Kavalleriesand 31
64295 Darmstadt
Germany
+49 61 51 80 76 03 (voice)
+49 61 51 80 78 30(fax)
DWilliams@eumetsat.de

2000 Chair Rep (Future)

Ms. Mary Toshie Kayano
Instituto Nacional de Pesquisas Espaciais
Av. Des Astronautas 1758
12201-970 Sao Jose Dos Campos
Brazil
+55 12 322 98 16 (voice)
+55 12 341 20 77 (fax)
mkayano@sir.inpe.br

1998 Chair Rep (Past)

Mr. Mukund Rao
Indian Space Research Organisation

Antariksh Bhavan
New BEL Road
560 094 Bangalore
India
+91 80 341 73 59 (voice)
+91 80 341 52 98 (fax)
isroeos@blr.vsnl.net.in

CEOS WORKING GROUP ON CALIBRATION AND VALIDATION

WORKING GROUP PROPER

BNSC	Mark Hutchins, DERA
	Dr. Christopher Mutlow, RAL
CCRS	Dr. Phillipe M. Teillet
China	Zhimin Zhang, SITP
	Dr. Liu He-guang, CSSAR
CNES	Dr. Frederic Adragna
	Dr. Jean-Louis Counil
CRI	Stella E. Belliss
CSA	Dr. Alan Hollinger
CSIRO	Dr. Ian Barton
DLR	Dr. Wolfgang Noack
	Dr. Klaus-Dieter Rockwitz
EC	Dr. Alan Belward
	Dr. Guiseppe Zibordi
ESA	Dr. Evert Attema
	Dr. Yves-Louis Desnos
EUMETSAT	Dr. Johannes Schmetz
	Dr. Stephen Tjemkes
GCOS	Dr. David Croom
IGBP	Dr. Phillipe M. Teillet, CCRS
INPE	Dr. Decio Castilho Ceballos
	Dr. G K Rayalu
ISRO	Dr. M.G. Chandrasekhar
	S. Kiran Kumar, SAC
NASA	Dr. James Dodge
NOAA	Dr. C.N. Nagaraja Rao
NSAU	Dr. Valery Tsymbal
NSC	Lasse H. Pettersson
OSTC	Michel Verbauwhede
Rosaviakosmos	Michail V. Novikov, RAS
SNSB	Dr. Marianne Treschow
STA/NASDA	Asuku Tanaka
	Masanobu Shimada
	Hiromi Oaku
WMO	Serguei Voiakine, CIMO
WCRP	Dr. Robert Schiffer, NASA

SUBGROUP CHAIRPERSONS

IVOS	Dr. Christopher Mutlow, RAL
Microwave Sensors	Dr. Elena Lobl, NASA
SAR	Dr. Yves-Louis Desnos, ESA/ESTEC
Terrain Mapping	Prof. Ian Dowman, U. College London
Land Surface Parameters	Dr. Jeffrey Privette, NASA, and Dr. Stefan Dech, DLR

GETTING IN TOUCH WITH WGCV

WGCV Chairperson

Dr. Alan Belward
EC/JRC
Joint Research Center Ispra
21020 Ispra
Italy
+39-332-789-298 (voice)
+39-332-789-073 (fax)
alan.belward@jrc.it

IVOS Subgroup Chairperson

Dr. Chris Multow
Space Science Department
Rutherford Appleton Laboratory
Chilton Didcot
Oxfordshire OX11 0QX
United Kingdom
+44 1235 446525 (voice)
+44 1235 446525 (fax)
c.t.mutlow@rl.ac.uk

Microwave Sensors Subgroup Chairperson

Dr. Elena Lobl
GHCC/UAH
977 Explorer Boulevard
Huntsville, Alabama 35806
+1 256-922-5912 (voice)
+1 256-922-5788 (fax)
Elena.Lobl@msfc.nasa.gov

SAR Subgroup Chairperson

Dr. Yves Louis Desnos
Mail Code NWP
ENVISAT-1 System and Payload Division
ESA-ESTEC
Keplerlaan 1
P.O. Box 299
2200 AG Noordwijk
The Netherlands
+31-71-565-4927 (voice)
+31-71-565-5617 (fax)
ydesnos@estec.esa.nl

Terrain Mapping Subgroup Chairperson

Prof. Ian Dowman
Department of Photogrammetry and Surveying
University College

Gower Street
London WCIE 6BT UK
+44-171-380-7226 (voice)
+44-171-380-0453 (fax)
idowman@ps.ucl.ac.uk

Land Surface Parameter Validation Chairpersons

Dr. Stefan Dech
German Aerospace Center (DLR)
German Remote Sensing Data Center (DFD)
Oberpfaffenhofen
D-82234 Wessling Germany
+49 8153 282885 (voice)
+49-8153-281420 (fax)
Stefan.Dech@dlr.de

Dr. Jeffrey Privette
EOS MODIS Land Validation Program
NASA/Goddard Space Flight Center
Greenbelt, MD 20771
USA
+1 301-614-6630 (voice)
+1 301-286-0239 (fax)
jeff.privette@gsfc.nasa.gov

CEOS WORKING GROUP ON INFORMATION SYSTEMS AND SERVICES (WGISS)

WORKING GROUP PROPER

ASI	Massimo Calabrese
BNSC	Alan Haskell, DERA
	Wyn Cudlip, DERA
	Martin Shelley
CAST	Qi Faren
CCRS	Terry Fisher
CNES	Jean-Pierre Antikidis
	Paul Kopp
CRI	Stella Belliss
CSA	Allan Hollinger
CSIRO	Mike Clarke
DLR	Thomas Ruwwe
	Joerg Gredel
	Gunter Schreier
EC	Peter Churchill
	Ken Inglis
ESA	Luigi Fusco
EUMETSAT	Robert Wolf
	Walter Dillen

FAO	Jelle Hielkema
GCOS	Alan Thomas
GOOS	Colin Summerhayes
GOOS/IOC	Ben Searle
GTOS	Jeff Tschirley
ICSU	David Clark, NOAA
IGBP	Gerard Szejwach
INPE	Jose Aguirre
ISPRS	Lutz Pluemer
	Roy Welch
	Ryutaro Tateishi
	Tuan-chih Chen
ISRO	Mukund Rao
NASA	Martha Maiden
	Matt Schwaller
	Richard des Jardins
	Ken McDonald
NOAA	Gerald Barton
	John Faundeen, USGS
NRSCC	Xu Jianping
	Wang Xinmin, CAS
NSAU	Oleksandr Kolodyazhnyiy
NSC	Per Erik Skroevseth
OSTC	Michel Verbauwhede
ROSHYDROMET	Alexander Uspensky
Rosaviakosmos	Vitaly Nechitailenko, RAS
SNSB	Per-Georg Jonsson
	Stefan Zenker
STA/NASDA	Takashi Moriyama, NASDA
	Hiroshi Ishiguro, RESTEC
	Shin-ichi Sobue
	Stephen Ward, Smith
WCRP	Sam Benedict
WMO	David McGuirk
UNEP	Mick Wilson
UNOOSA	Adigun Ade Abiodun

SUBGROUP CHAIRPERSONS

Access	Chairperson: Ken McDoland, NASA
	Vice-Chairperson: Paul Kopp, CNES
Network	Chairperson (Acting): Richard des Jardins, NASA
	Vice-Chairperson: Shin-ichi Sobue, NASDA
Data	Chairperson: Wyn Cudlip, DERA
	Vice-Chairperson: Vacant

GETTING IN TOUCH WITH WGISS

WGISS Chairperson	Mr. Takashi Moriyama
until November 1999	NASDA

Office of Earth Observation Systems
Earth Observation Planning Department
2-4-1 Hamamatsu-cho
Minato-ku, Tokyo 105-8060
Japan
+81-3-3438-6332 (voice)
+81-3-5401-8703 (fax)
moriyama.takashi@nasda.go.jp

after November 1999

Dr. Peter Churchill
EC/JRC
SSSA Unit, Space Applications Institute
Joint Research Center Ispra
21020 Ispra
Italy
+39-0332-785031 (voice)
+39-0332-7895364 (fax)
peter.churchill@jrc.it

WGISS Vice Chairpersons
until November 1999

Dr. Peter Churchill
EC/JRC
Joint Research Center Ispra
21020 Ispra
Italy
+39-0332-785031 (voice)
+39-0332-7895364 (fax)
peter.churchill@jrc.it

Dr. Gerard Szejwach
IGBP-DIS Director
42 Av. Gustave Coriolis
F-31057 Toulouse Cedex
France
+33-561-078580 (voice)
+33-561-078589 (fax)

after November 1999

Terry Fisher
CCRS
Room 650, 615 Booth Street
Ottawa, Ontario K1A OY7
Canada
+1-613-947-1300 (voice)
+1-613-947-2410 (fax)
Terry.Fisher@ccrs.nrcan.gc.ca
Mick Wilson
UNEP
UNEPnet Services

	Environment Information Systems P.O. Box 30552 Nairobi Kenya +254-2-623-436 (voice) +254-2-623-495 (fax) mick.wilson@unep.org
WGISS Secretariat	Mr. Hiroshi Ishiguro NASDA/RESTEC Roppongi First Building, 12F 1-9-9 Roppongi Minatoku Tokyo 106-0032 Japan +81-3-5561-4547 (voice) +81-3-5561-9541 (fax) ishiguro@restec.or.jp
Access Subgroup Chairperson	Mr. Ken McDonald NASA Goddard Space Flight Center Mail Code 423 Greenbelt, MD 20771 USA +1-301-614-5331 (voice) +1-301-614-5270 (fax) ken.mcdonald@gsfc.nasa.gov
Network Subgroup Chairperson (Acting)	Mr. Richard des Jardins National Aeronautics and Space Administration (NASA) Ames Research Center NASA Research and Education Network (NREN) MS 233-21 Moffett Field, California 94035 USA +1-650- 604-4764(voice) +1-650-604-3080 (fax) rdesjardins@arc.nasa.gov
Data Subgroup Chairperson	Mr. Wyn Cudlip DERA Space Department Room 1058, Arthur C. Clarke Building DERA Farnborough Hants GU14 0LX UK +44-1252-392-283 (voice) +44-1252-396-310 (fax) w_culdip@scs.dera.gov.uk

APPENDIX B: CEOS DOCUMENTS, SERVICES AND URLs

To obtain copies of any CEOS document, visit the CEOS homepage (*http://www.ceos.org*) for information or contact the appropriate agency/individual/URLs listed below or in Appendix A.

MAIN CEOS DOCUMENTS AND SERVICES

CEOS Home Page
Information on and documents published by CEOS can be obtained from the CEOS home page at *http://www.ceos.org*.

CEOS Brochure
Copies of the 1998 CEOS Brochure can be obtained from the CEOS Secretariat or in PDF format at *http://nasda.ceos.org.brochure.pdf*.

CEOS Consolidated Report
The CEOS Consolidated Report is updated annually in advance of the fall Plenary session. Copies can be obtained from the CEOS Secretariat or in PDF format at *http://www.earth.nasa.gov/whatis/ceos/report.html*.

CEOS Newsletter
The CEOS Newsletter is published twice a year and is available in PDF format at:
http://nasda.ceos.org/ceosnews_menu_e.html.
To be added to the mailing list, contact the STA/NASDA representative of the CEOS Secretariat identified below at via email at ceosj@ipx.tksc.nasda.go.jp.

CEOS Database
The CEOS Database (formerly referred to as the CEOS Dossier) is available in two forms:
- an on-line system available via the World Wide Web (*http://sat.wmo.ch/stations/SatSystem.html*);
- as a PC-based system for local use (available by request from the WMO).

CEOS Yearbook
The CEOS Yearbook contains a hard copy, condensed version of the database. Copies of the 1997 Yearbook can be obtained from the CEOS Secretariat.

CD-ROM: Resources in Earth Observation: Case Studies, Data and Information for Schools and Developing Countries
The CD-ROM is designed for use primarily by developing countries and educators. Copies of the 1997 issue can be obtained from the CEOS Secretariat or on-line at: *http://www-projet.cnes.fr/ceos/cdrom-97/*.

CEOS Information Locator System (CILS)
CILS is a prototype electronic information service designed primarily to meet the requirement of users of Earth observation and remote sensing data in developing countries. CILS can be accessed at any one of the URLs listed below.

CEOS International Directory Network (IDN)
IDN is an international effort to assist researchers in locating information on available data sets. The IDN is sponsored by WGISS as a service to both the Earth and space science communities. The IDN provides open, on-line access to information on worldwide scientific data including Earth sciences, space physics, solar physics, planetary science and astronomy/astrophysics. The IDN can be accessed through any one of the URLs listed below.

URLs

CEOS	
CEOS	*http://www.ceos.org*
CEOS Brochure	*http://nasda.ceos.org.brochure.pdf*
CEOS Consolidated Report	*http://www.earth.nasa.gov/whatis/ceos/report.html*
CEOS Newsletter	*http://nasda.ceos.org/ceosnews_menu_e.html*
CEOS Database	*http://sat.wmo.ch/stations/SatSystem.html*
CD-ROM	*http://www-projet.cnes.fr/ceos/cdrom-97/*
WGISS	
WGISS	*http://wgiss.ceos.org*
WGISS Access Subgroup	*http://spsosun.gsfc.nasa.gov/ceos-as/*
WGISS Data Subgroup	*http://www.space.dera.gov.uk/ceos/ds_homepage.html*
WGISS Network Subgroup	*http://nic.nasa.gov/ceos-ns/index.html*
CILS	*http://cils.eoc.nasda.go.jp*
	http://cils.dlr.de
	http://cils.jrc.it
	http://cils.unep.org
	http://cils.eoc.csiro.au
	http://cils.cetre.unep.net/
	http://cils.sepa.unep.net/
IDN	*http://gcmd.gsfc.nasa.gov/ceosidn*
	http://earth1.esrin.esa.it/idn/hp.html
	http://gcmd.eoc.nasda.go.jp
	http://www.grid.unep.ch/
AVHRR 1 KM project	*http://edcwww.cr.usgs.gov/landdaac/1KM/1kmhomepage.html*
Global Mapping Task Team	*http://vast.uah.edu/ceos/ceos.html*
GLOBE Project	*http://www.ngdc.noaa.gov/seg/topo/globe.html*
WGCV	
WGCV	*http://wgcv.ceos.org/*
WGCV SAR SG	*http://www.estec.esa.nl/ceos-sar/*
WGCV Terrain Mapping SG	*http://wgcv.ceos.org/subgroups/tm/tm.htm*
WGCV Microwave Sensors SG	*http://wgcv.ceos.org/subgroups/ms/ms.htm*
WGCV Infrared and Visible Optical Sensors SG	*http://wgcv.ceos.org/subgroups/ivos/ivos.htm*
WGCV Dossier	*http://spso.gsfc.nasa.gov/calval/homepage.html*
WGCV Newsletter	*http://wgcv.ceos.org/news.htm*

IGOS

IGOS Partnership	*http://www.igospartners.org*
IGOS Brochure	*http://nasda.ceos.org/igos_brochure.pdf*

CEOS Members

ASI	*http://www.asi.it/*
BNSC	*http://www.bnsc.gov.uk/*
CSIRO	*http://www.cossa.csiro.au/*
CSA	*http://www.science.sp-agency.ca/*
CNES	*http://www.cnes.fr/*
DLR	*http://www.dlr.de/*
EC	*http://europa.eu.int/comm/index_en.htm*
ESA	*http://www.esrin.esa.it/*
EUMETSAT	*http://www.eumetsat.de/en/*
INPE	*http://www.inpe.br/*
ISRO	*http://www.isro.org/*
NASA	*http://www.earth.nasa.gov/*
NASDA (STA)	*http://www.nasda.go.jp* *(http://www.sta.go.jp)*
NOAA	*http://www.noaa.gov/*
SNSB	*http://nos.snsb.se/english.htm*

CEOS Associates

CCRS	*http://www.ccrs.nrcan.gc.ca/ccrs/*
CRI	*http://www.landcare.cri.nz/*
GCOS	*http://www.wmo.ch/*
GOOS	*http://ioc.unesco.org/iocweb/activities/goos.htm*
GTOS	*http://www.fao.org/GTOS/*
ICSU	*http://www.icsu.org*
IGBP	*http://www.igbp.kva.se/*
IOC	*http://ioc.unesco.org/iocweb/*
ISPRS	*http://www.p.igp.ethz.ch/isprs/isprs.html*
NSC	*http://www.spacecentre.no/*
OSTC	*http://www.belspo.be/belspo/home/home_uk.htm*
SAC (CSIR)	*http://www.sac.co.za/sachome.htm* *(http://www.csir.co.za)*
UNEP	*http://www.unep.org/*
UNESCAP	*http://unescap.org/*
UNFAO	*http://www.fao.org/*
UNOOSA	*http://www.un.or.at/OOSA/*
WCRP	*http://www.wmo.ch/*
WMO	*http://www.wmo.ch/*

APPENDIX C: GUIDELINES FOR INITIATING NEW PROJECTS AND ACTIVITIES WITHIN CEOS

The work of CEOS spans the full range of activities required for proper international coordination of Earth observation programs and maximum utilization of their data, and ranges from the development of detailed technical standards for data product exchange, through to the establishment of high level interagency agreements on common data policies. Access to CEOS is through a Plenary Member, WG Member or Secretariat Member. Funding and resources required will have to be contributed by participating CEOS agencies. CEOS can provide the framework for efficient coordination across the CEOS agencies.

CEOS works through a 'best efforts' approach. New projects or activities should further the cause of CEOS and be part of the CEOS mandate. It should be noted that activities could be carried out as part of normal WG and subgroup activities. The duration of the project (or activity) and overhead associated with linking the project (or activity) with CEOS would help define whether or not it lies within the CEOS domain.

New projects or activities that are considered to lie within the CEOS domain can take a more formal structure by classification under one of the following categories:

- normal WG or subgroup activity;
- *ad hoc* project or activity;
- specific projects;
- one-time calibration campaign.

New activities that fit within the Terms of Reference of CEOS WGs can be initiated or integrated into the work plans of the WGs through the WG Chairperson. Activities that seem to fall outside would require development and approval at the Plenary level. Such projects will be considered on a case-by-case basis and can be introduced to the Plenary either by a Plenary Member or be presented to the Plenary via the Secretariat.

Persons who are interested in initiating new activities for CEOS are encouraged to discuss them at the earliest possible opportunity with a Plenary Member, WG Member or the Secretariat to ensure the proposals receive prompt attention and are dealt with in the best manner.

APPENDIX D: CEOS WORKING GROUP AND SUBGROUP TERMS OF REFERENCE

CEOS WORKING GROUP ON CALIBRATION AND VALIDATION (WGCV)

New Terms of Reference were approved at the Fifth CEOS Plenary, December 1992, at which time WGCV was established as a standing CEOS Working Group.

Since its initiation, the WGCV has operated with one Chairperson. In 1995, the Secretariat asked the WGCV to consider the creation of a position of Vice-Chairperson. The WGCV decided that a Vice-Chairperson was not required for successful conduct of its work, and that a three to five year term for a Chairperson was appropriate. To provide continuity, the new Chairperson should be identified about one year before the end of the incumbent's term. As well, the Chairpersons of the WGCV subgroups should have terms of similar length, three to five years. This approach was presented to the ninth CEOS Plenary in 1995 and was accepted. The terms of reference were modified accordingly.

Membership
Membership in CEOS WGCV is open to all Members of CEOS as defined in the CEOS Terms of Reference, including Observers and Affiliates. Members may include in their delegations to the WGCV meetings any participants who have relevant expertise to contribute to the objectives of the WGCV.

Objectives
The objectives of the WGCV are to enhance coordination and complementarity, to promote international cooperation and to focus activities in the calibration and validation of Earth observations[3] for the benefit of CEOS Members and the international user community. Meeting these objectives will include the promotion of:

- Exchange of technical information and documentation;
- Investigation of possibilities for technical coordination and cooperation for space and ground segments;
- Coordination of calibration and validation campaigns and programs; and
- Optimization and sharing of available facilities, expertise, and resources as appropriate.

Specific objectives are:

1) Sensor-specific calibration and validation - to document and establish forums for the assessment and recommendation of, current techniques and standards for pre- and post-launch characterization and calibration;
2) Geophysical validation - To document and establish forums for the assessment and recommendation of techniques for validation of geophysical parameters derived from Earth observation satellite systems.

Procedures
The WGCV shall meet when appropriate, but at least once per year, rotating venue among members. The WGCV Chairperson, designated by the Plenary, shall prepare and distribute minutes for each meeting. A suitable term of office for the Chairperson is three to five years. A new Chairperson desig-

[3] Includes cryosphere, hydrosphere, lithosphere, biosphere, and atmosphere.

nate is identified about one year before the term ends. At each meeting of the WGCV, the time, place, and host for the next meeting shall be established. For each meeting of the WGCV, each Member shall prepare a report on the member's current and planned calibration and validation activities.

The CEOS WGCV shall coordinate its work with other international groups involved in related activities as described in the CEOS Terms of Reference.

Each Member shall designate a point-of-contact for the WGCV correspondence.

The WGCV may propose modifications to these Terms of Reference, and such modifications will be submitted to the Plenary for approval at the next Plenary meeting.

Subgroups may be established to perform detailed technical work in specific areas. Subgroups shall be established by the consensus of the WGCV. The WGCV shall develop Terms of Reference for each subgroup. The Chairperson of each Subgroup shall report at each WGCV meeting on the subgroup's progress and plans.

The WGCV Library shall serve as the repository for documents, such as meeting minutes and publications produced by the WGCV, and other material as may be agreed by the WGCV.

The WGCV shall work towards developing agreement on common terminology.

The WGCV shall develop additional procedures as may be required.

CEOS WGCV SUBGROUP ON INFARED AND VISIBLE OPTICAL SENSORS (IVOS)

- To identify and agree on calibration and validation requirements and standard specifications for infrared and visible optical sensors;
- To promote international and national collaboration for all IVOS and, thus, assist in the improved application of data from satellite sensors;
- To include all sensors (ground-based, airborne, and satellite) where there is a direct link to the cal/val of satellite sensors;
- To identify test sites and encourage continuing observations and intercomparison of data from these sites;
- To encourage the timely and unencumbered release of data relating to cal/val activities including details of pre-launch and in-orbit calibration parameters.

CEOS WGCV SUBGROUP ON MICROWAVE SENSORS

The Passive Microwave Subgroup was approved by the WGCV in May 1992, but was renamed the Subgroup on Microwave Sensors in February 1994, to encompass a broader range of microwave systems, both passive and active (such as altimeters, scatterometers and real-aperture radars), from decimeter to submillimeter wavelengths.

- To promote national and international cooperation in the calibration and validation of microwave

sensors and to enhance coordination and complementary in experiments and test facilities for the benefit of the CEOS members and the international user community;
- To promote accurate calibration and validation of microwave sensors, through standardization of terminology and measurement practices.
- To provide a forum for discussion of current issues and for exchange of technical information.

CEOS WGCV SUBGROUP ON SAR

- To act as a forum for international technical interchange on the evolving methodologies, techniques and equipment of SAR calibration and validation;
- To determine standards definitions and cal/val requirements for SAR imaging systems and to support changes in CEOS formats and user products as appropriate;
- To facilitate international cooperative programs in the cal/val of SAR systems.

CEOS WGCV SUBGROUP ON TERRAIN MAPPING

- To provide test data sets of DEMs and other relevant material over a number of test sites covering different terrain, land cover, and climatic conditions;
- To provide guidelines for the use of the test data to allow evaluation and comparison of DEMs from different sensors and as a means of validating data from such sensors;
- To provide a forum for discussion of matters related to DEMs derived from satellite data.

CEOS WGCV SUBGROUP ON LAND SURFACE PARAMETER VALIDATION

- To promote the quantification and characterization of satellite land product accuracy
- To share land product validation past experience and lessons learned
- To move towards the generation of 'standardized products with known accuracy' from similar sensing systems in the context of data continuity
- To establish relationships between like products - e.g. Vegetation Indices
- To develop in-situ validation measurement standards, protocols and traceability
- To co-ordinate international validation activities
- To improve access to validation data sets.

CEOS WORKING GROUP ON INFORMATION SYSTEMS AND SERVICES (WGISS)

Mission Statement

Recognizing the importance of global issues, the WGISS will stimulate, coordinate, and monitor initiatives, thereby enabling users at a global, regional, and local level to exploit more effectively, and benefit from, data generated by Earth observing satellites and other sources.

Objectives

The overall objective of WGISS is to facilitate data and information management and services for users and data providers in dealing with global, regional, and local issues. In particular, it will address the capture, description, processing, access, retrieval, utilization, maintenance and exchange of space-borne Earth observation data and supporting ancillary and auxiliary data and information, enabling improved interoperability and interconnectivity of information systems and services.

Specific goals are to:

- Enable Earth observation data and information services to be more accessible and usable to data providers and data users worldwide through international coordination;
- Enhance the complementary, interoperability, and standardization of Earth observation data and information management and services;
- Foster easier exchange of Earth observation data and information through networks and other means, to meet the requirements of users and data providers.

To achieve these objectives and goals, WGISS will:

- Synthesize and respond to the needs of users and data providers in a diverse international community;
- Foster global interconnectivity and interoperability of data and information systems and services;
- Identify, influence, and recommend standards for effective data interuse;
- Support improvements in the quality and reliability of data, information, and supporting systems and services;
- Monitor development of new technologies and encourage their use as appropriate;
- Develop agreement on common terminology;
- Foster ongoing, effective communications among CEOS participants and others.

Implementation

Strategies and activities to meet the objectives and goals of WGISS, stated above, will be fully defined via a long-term plan covering five years. The long-term plan will be submitted to the CEOS Plenary for endorsement.

Structure and Procedures

The WGISS will meet twice per year, rotating meeting venue among participants. The WGISS Chairperson and two Vice Chairpersons will be designated by the CEOS Plenary and will rotate among WGISS members every two years. One Vice Chairperson will be designated to assume the Chairperson after two years. One Vice Chairperson will be charged to facilitate effective interaction with users. The Chairperson of WGISS will prepare and distribute minutes for each meeting. At each meeting of the WGISS, the time, place, and host for the next meeting will be established.

The WGISS will coordinate its work with other CEOS Working Groups and other international groups involved in related activities, to cooperate and avoid duplication of effort.

Membership in CEOS WGISS is open to all Members and Associates of CEOS as defined in the CEOS Terms of Reference. Delegations may include relevant experts from non-member organizations when appropriate.

Each CEOS Member and Associate will designate a point of contact for WGISS correspondence.

Subgroups may be established by the consensus of the WGISS, to perform detailed technical work in specific areas. Subgroup Chairpersons will be appointed by the WGISS for three years, based on nominations from each Subgroup. The WGISS will approve Terms of Reference for each Subgroup. The Chairperson of each Subgroup will report at each WGISS meeting on the Subgroup's progress and plans.

The WGISS will report to the CEOS Plenary, bringing forward recommendations and proposals as appropriate.

The WGISS may propose modifications to these Terms of Reference, and such modifications will be submitted to the CEOS Plenary for approval at the next CEOS Plenary meeting.

CEOS WGISS DATA SUBGROUP

Scope
The Subgroup will primarily address the following major goal of WGISS:

- Enhance the complementary, interoperability and standardization of Earth observation data and information management and services.

The Subgroup will take into account the requirements of users and CEOS participants and will undertake tasks to foster the interuse of data by ensuring compatibility of data content, formats, and tools used in the generation of data products.

Membership
The Subgroup shall be open to all Members and Associates of CEOS. The Subgroup may invite guest participation from other organizations by decision of the Subgroup members.

Subgroup Chairperson
WGISS will appoint a Subgroup Chairperson for a period of three years. WGISS will take account of any recommendations of the Subgroup regarding the selection of a Chairperson.

Tasking
WGISS will request the Subgroup to undertake tasks within the Scope of the Subgroup. These may originate from the Plenary, from within WGISS itself or be proposed by the Subgroup for adoption by WGISS. The Subgroup will consider each such request and advise WGISS of the plan to undertake the task. In the event that a task cannot be undertaken, the Subgroup Chairperson will advise WGISS accordingly and, if possible, recommend an alternative course of action for WGISS.

Activities
The Subgroup will work within the framework defined in the WGISS plan. Particular activities will be as follows:

- The Subgroup will undertake tasks as agreed with WGISS;
- The Subgroup will consider the needs of users and CEOS participants and propose to WGISS new tasks as appropriate to achieve the purpose of the Subgroup;
- The Subgroup will facilitate exchange of information and ideas between members;
- The Subgroup will provide information to maintain the WGISS plan and Task Register as defined in the WGISS plan.

Reporting
The Subgroup Chairperson shall report at each WGISS meeting on Subgroup progress and plans. The Subgroup will take guidance and direction from WGISS.

CEOS WGISS ACCESS SUBGROUP

Scope
The Subgroup will primarily address the following major goal of WGISS:
- Enable Earth observation data and information services to be more accessible, interoperable and usable to data providers and data users worldwide through international co-ordination.

The Subgroup will take into account the requirements of users and CEOS participants and will undertake tasks to develop or demonstrate improved method and tools for location, advertising, access and exchange of information.

Membership
The Subgroup shall be open to all Members and Associates of CEOS. The Subgroup may invite guest participation from other organizations by decision of the Subgroup members.

Subgroup Chairperson
WGISS will appoint a Subgroup Chairperson for a period of three years. WGISS will take account of any recommendations of the Subgroup regarding the selection of a Chairperson.

Tasking
WGISS will request the Subgroup to undertake tasks within the scope of the Subgroup. These may originate from the Plenary, from within WGISS itself or be proposed by the Subgroup for adoption by WGISS. The Subgroup will consider each such request and advise WGISS of the plan to undertake the task. In the event that a task cannot be undertaken, the Subgroup Chairperson will advise WGISS accordingly and, if possible, recommend an alternative course of action for WGISS.

Activities
The Subgroup will work within the framework defined in the WGISS plan. Particular activities will be as follows:
- The Subgroup will undertake tasks as agreed with WGISS;
- The Subgroup will consider the needs of users and CEOS participants and propose to WGISS new tasks as appropriate to achieve the purpose of the Subgroup;
- The Subgroup will facilitate exchange of information and ideas between members;
- The Subgroup will provide information to maintain the WGISS plan and Task Register as defined in the WGISS plan.

Reporting
The subgroup Chairperson shall report at each WGISS meeting on Subgroup progress and plans. The Subgroup will take guidance and direction from WGISS.

CEOS WGISS NETWORK SUBGROUPS

Scope
The Subgroup will primarily address the following major goal of WGISS:

- Foster easier exchange of Earth observation data and information through networks to meet the requirements of users and data providers.

The Subgroup will take into account the requirements of users and CEOS participants and will undertake tasks to develop or demonstrate improved methods and tools in areas such as network architecture, interoperability, performance management and network security.

Membership
The Subgroup shall be open to all Members and Associates of CEOS. The Subgroup may invite guest participation from other organizations by decision of the Subgroup members.

Subgroup Chairperson
WGISS will appoint a Subgroup Chairperson for a period of three years. WGISS will take account of any recommendations of the Subgroup regarding the selection of a Chairperson.

Tasking
WGISS will request the Subgroup to undertake tasks within the Scope of the Subgroup. These may originate from the Plenary, from within WGISS itself or be proposed by the Subgroup for adoption by WGISS. The Subgroup will consider each such request and advise WGISS of the plan to undertake the task. In the event that a task cannot be undertaken, the Subgroup Chairperson will advise WGISS accordingly and, if possible, recommend an alternative course of action for WGISS.

Activities
The Subgroup will work within the framework defined in the WGISS plan. Particular activities will be as follows:

- The Subgroup will undertake tasks as agreed with WGISS;
- The Subgroup will consider the needs of users and CEOS participants and propose to WGISS new tasks as appropriate to achieve the purpose of the Subgroup;
- The Subgroup will facilitate exchange of information and ideas between members;
- The Subgroup will provide information to maintain the WGISS plan and Task Register as defined in the WGISS plan.

Reporting
The Subgroup Chairperson shall report at each WGISS meeting on Subgroup progress and plans. The Subgroup will take guidance and direction from WGISS.

APPENDIX E: SELECTION OF WORKING GROUP CHAIRS

BACKGROUND

The CEOS Terms of Reference make provision for the creation and dissolution of working groups:

> "CEOS may establish, as mutually agreed, standing working groups where an *ad hoc* status is deemed insufficient. More permanent status may be required to ensure long-term continuity of work in certain areas where the magnitude and complexity of the task is not suitable to short-term solutions. These standing working groups shall continue without requiring specific confirmation by the Plenary. The Chairpersons of such groups shall report at each CEOS Plenary session on accomplishments and future plans. If the consensus of the Plenary is that such a group is no longer required, the Plenary may discontinue the group. In the absence of such a decision, however, the standing working group shall continue. Representatives from all CEOS Members are invited to participate in all working groups."

The 1996 Plenary adopted general guidelines on the selection of working group chairs. While the guidelines are intended to address most commonly occurring situations, circumstances may arise which have not been explicitly described. Rather than attempting to develop highly detailed procedures, the Plenary agreed that these guidelines should be used as a starting point and adjusted, as appropriate, to fit the specific situation.

REQUIREMENTS FOR OFFICE

The following are considered important characteristics for the selection of Working Group Chairpersons:

1) The agency sponsoring the Working Group Chairperson should provide adequate support to the position, including travel support, secretariat services, and time to devote to the work.
2) The Working Group Chairperson should have a good knowledge of CEOS and of the area of work for the working group, including both the technical and policy aspects.
3) Ideally, the Working Group Chairperson should have at least one year of experience as a member of the respective working group.
4) When possible, there should be a period of overlap or transition between the outgoing and incoming Working Group Chairpersons.
5) Ideally, the Working Group Chairperson should have a demonstrated ability to effectively lead technical working groups.
6) The Working Group Chairperson may be a member of any participating CEOS agency (i.e., any member or associate agency).
7) In cases where a Vice-Chairperson is designated to automatically assume the Chairperson position, these criteria would be considered in the selection of the Vice-Chairperson.

For the case of an existing working group, the group is usually in the best position to determine the individual qualifications of a participant to lead the group in its work. However, in the case of the formation of a new group, candidates should be identified through a higher-level search process.

EXISTING WORKING GROUPS

The following process should be followed for the selection of working group chairpersons:

1) During the year prior to the expected change of office (or as soon as practical), the working group should identify one or more candidates for the position.
2) The working group should forward the name of the candidate to the CEOS Chairperson as soon as possible.
3) The CEOS Chairperson should contact the candidate's agency to obtain a formal statement of support, if not included with the nomination.
4) Once the statement of support has been received, the name of the candidate, along with the support statement, should be reported by the CEOS Chairperson in timely correspondence to all participating CEOS agencies.
5) Alternatively, if the working group is unable to select a single candidate, then the CEOS Chairperson will work with the working group and the organizations of the candidates to verify organizational support, etc., and to identify the best candidate for the position at that time. The CEOS Chairperson, after determining consensus in accordance with the CEOS Terms of Reference, would then report the name of the candidate in timely correspondence to participating CEOS agencies.
6) If the Working Group is unable to identify a viable candidate, then the CEOS Chairperson, working with the Working Group members and participating CEOS agencies, should actively seek candidates for the position. The CEOS Chairperson, after determining consensus in accordance with the CEOS Terms of Reference, would then report the name of the candidate in timely correspondence to participating CEOS agencies.
7) In cases where a Vice-Chairperson is designated to automatically assume the Chairperson position, this process would be used to identify the Working Group Vice-Chairperson.

RESIGNATION OF WORKING GROUP CHAIRPERSON

There may be times when an individual is unable to continue as Chairperson throughout an approved term of office. In such situations, the sponsoring agency may be willing to continue support and propose a replacement chairperson to serve out the current term. To allow for such events, the following procedures should be followed:

1) Except in cases where the Vice Chairperson is designated to automatically assume the chair position, if an individual can no longer continue as Chairperson during a term of appointment, the supporting agency for the outgoing Chairperson may designate a successor for the Chairperson to the Working Group to serve out the original term.
2) If the previously supporting agency does not designate a successor for the Chairperson, the standard procedure for designating new Chairpersons of existing Working Groups applies.
3) In cases where a Vice Chairperson is designated to automatically assume the Chairperson position, the Vice Chairperson will become Chairperson upon the resignation of the previous Chairperson and will serve a nominal term as specified in the Terms of Reference for the Working Group.

4) Whenever there is a change in the Chairperson position, the Working Group shall notify the CEOS Chairperson in a timely manner. Upon confirmation of sponsoring agency support for the incoming Working Group Chairperson, the CEOS Chairperson shall notify participating CEOS agencies of the change.

NEW WORKING GROUPS

When a new Working Group is created by the CEOS Plenary, whether to address a new area of work or formed out of predecessor Working Groups, the following process should be followed:

1) The CEOS Chairperson shall invite nominations, including statements of organizational support, from participating CEOS agencies.
2) After review of the candidates and the statements of support from their organizations, the CEOS Chairperson, after consultation with CEOS Members, should communicate the recommendation in a timely manner to participating CEOS agencies.
3) In the case of a new Working Group, the recommendation for chairperson, vice chairperson(s) (if applicable), along with the proposed terms of reference, will be discussed and adopted at a CEOS Plenary meeting, in accordance with the CEOS Terms of Reference.

SPECIFYING TERMS OF OFFICE

The specified terms of office for Working Group Chairpersons differ between WGISS and WGCV. The WGISS Terms of Reference call for a two-year term for the Chairperson and Vice Chairperson, while the WGCV Terms of Reference specify a three to five year term. There is no evidence that uniformity in such practices necessarily leads to a more effective Working Group. However, it seems prudent to specify a nominal term of office for the Chairperson of each Working Group. Therefore, the Terms of Reference for each Working Group should specify a nominal term of office for the Working Group Chairperson. In cases where a Vice Chairperson is designated to automatically assume the Chairperson position, the Terms of Reference for the Working Group shall also specify a nominal term of office for the Working Group Vice Chairperson.

APPENDIX F: DATA EXCHANGE PRINCIPLES

CEOS has adopted two sets of data exchange principles:

1) Satellite Data Exchange Principles in Support of Operational Environmental Use For the Public Benefit; and
2) Satellite Data Exchange Principles in Support of Global Change Research.

SATELLITE DATA EXCHANGE PRINCIPLES IN SUPPORT OF OPERATIONAL ENVIRONMENTAL USE FOR THE PUBLIC BENEFIT

At the Eighth CEOS Plenary meeting held in Berlin in 1994, the following data provision principles were adopted, with EUMETSAT abstaining.

Resolution on Principles of Satellite Data Provision in Support of Operational Environmental Use For the Public Benefit[4]

RECOGNIZING that CEOS agencies are actively involved in supporting national, regional, and international operational environmental efforts for the public benefit, as well as pursuing other uses of Earth observation satellite data;
RECOGNIZING the investments made in particular by governments and international agencies in support of operational environmental efforts for the public benefit;
RECOGNIZING that both satellite and non-satellite data have potential economic and social value, that both forms of data are important to operational environmental activities, and that the sustained acquisition, processing, and supply of data involve investments and costs;
RECOGNIZING that, in various national and international contexts, the sustainability of the observing systems and the end-to-end services to the users is a pre-requisite to full operational environmental use for the public benefit;
RECOGNIZING that data provision should take into account the benefits of expanded data use, as well as investments and costs;
RECOGNIZING that Earth observation data, especially satellite data, are essential to governments and public authorities and relevant international organizations in fulfilling certain mandates, such as the protection and preservation of human life, the Earth, and property from the effects of natural disasters, severe weather, and environmental emergencies, and support for improved environmental management;
RECOGNIZING more than 100 years of cooperation within the international meteorological community in the free and unrestricted exchange of basic meteorological data;
ANTICIPATING the emerging operational requirements from global observing systems, such as the Global Climate Observing System, the Global Ocean Observing System, and the Global Terrestrial Observing System;
RECOGNIZING the value of user feedback to improve responsiveness of data suppliers;

[4] These principles apply to satellite data unless otherwise explicitly stated; other relevant data (e.g., *in-situ* and airborne data) may be considered at a later time. EUMETSAT abstained from voting on these Principles.

RECOGNIZING the existence of various legal regimes for data provision and different policies for pricing and data ownership;
ANTICIPATING the potential benefits of compatible policies and mechanisms for data provision in obtaining access to data for operational environmental use for the public benefit;
REAFFIRMING the commitment of CEOS members to the general principle of non-discriminatory access to data;
RECOGNIZING the common goal of providing data for operational environmental use for the public benefit from all appropriate missions;
RECOGNIZING also that the constraints of mission operations and of available resources may require different mechanisms for data provision for different programs;

CEOS Members endorse the following principles relating to data provision in support of operational environmental use for the public benefit and agree to work toward implementing them to the fullest extent possible within available resources:

1) Criteria and priorities for data acquisition, processing, distribution, preservation, archiving, and purging should be harmonized to take into account the needs of users of data for operational environmental use for the public benefit.

2) Real-time and/or archived data for operational environmental use for the public benefit should be made available on time scales compatible with user requirements and within agency capabilities.

3) CEOS data suppliers should provide, e.g., through the CEOS International Directory Network, easily accessible information about the data and related mission parameters, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data.

4) Recognized standards, to be defined and developed in common, including those generated by CEOS Working Groups, should be used to the greatest extent practical for recording/storage media and for processing and communication of data sets.

5) To optimize the use of data for operational environmental use for the public benefit, CEOS members should establish appropriate data provision mechanisms.

6) Programs should have no exclusive period of data use except where there is a need to provide for data validation. An initial period of exclusive data use should be limited and explicitly defined. The goal should be release of data in some preliminary form within three months after the start of routine data acquisition.

DEFINITIONS

Data provision
- Distribution of data among CEOS agencies and dissemination of data by CEOS agencies to the user community.

For the Public Benefit
- The pursuit of social and equitable objectives, directed by government or public authority.

Non-discriminatory

- All users in a clearly defined category obtain data on the same terms and conditions, and the categories are defined in such a way that all potential users will be included in categories with access to data.

Operational environmental use for the public benefit

- Use of data to provide a regular environmental service for the public benefit;
- Carried out by public national or international Earth observation agencies, or other entities designated by governments or public authorities, to support public benefit mandate;
- Examples include use of data to carry out a mandate of environmental observation and prediction or missions relating to environmental management or regulation.

Real time

- Making data available by direct broadcast or immediately after acquisition and/or initial processing.

Sustainability

- Long-term availability (supported by an appropriate replacement strategy), affordability, and capacity to adapt to evolving user needs.

SATELLITE DATA EXCHANGE PRINCIPLES IN SUPPORT OF GLOBAL CHANGE RESEARCH

At the Sixth CEOS Plenary meeting held in London in 1992, the following data exchange principles were adopted. They represent an elaboration on the principles adopted in 1991.

In addition to the revisions to the data exchange Principles, the Sixth Plenary agreed that the tasks contained in the report of the October 1992 *ad hoc* data policy meeting hosted by CNES be implemented by the Working Group on Data. As noted in the minutes of the Sixth CEOS Plenary, a plan was presented for implementing Principle 4:

- Data providers need to submit standard product catalogs to the CEOS IDN.
- Data requirements need to be identified by *ad hoc* committees of the relevant international research programs.
- Global change researchers need to be chosen through peer review or a similar process within the context of the research priorities of relevant programs.
- Written agreements (including protection of data rights and requirements for publication) need to be signed by selected researchers and their sponsoring institutions.
- Data must be shared among selected users.

Resolution on Satellite Data Exchange Principles
in support of
Global Change Research

RECOGNIZING that the members of CEOS are actively involved in supporting global change/climate and environmental research and monitoring efforts of the international scientific community, as well as pursuing other uses of Earth observations data such as local/regional research, operational environmental monitoring, and commercial;

RECOGNIZING the investments made by governments and international agencies in support of global change/climate research and environmental research and monitoring and the value of non-satellite data to these programs;

TAKING INTO ACCOUNT that the acquisition, processing, and supply of data, especially space data, involve major investments, and that data have value;

RECOGNIZING that these investments and values should be respected by data suppliers and users;

RECOGNIZING the existence of various policy aims such as maximizing the use of data from all sources and shifting the funding responsibility for certain remote-sensing systems to users or other sources;

AWARE that success in global change/climate and environmental research and monitoring requires a continuing commitment to the establishment, maintenance, validation, description, accessibility, and distribution of high-quality long-term data sets, many of which rely on spaceborne observations;

ANTICIPATING the potential benefits of compatible policies and mechanisms for data exchange in obtaining access to global data;

REAFFIRMING the commitment of CEOS Members to the general principle of non-discriminatory access to data;

RECOGNIZING the importance of appropriate legal regimes for the exchange of remotely sensed data;

RECOGNIZING the common goal of providing data to global change researchers from all missions on a consistent basis reflecting primarily the cost of filling the user request;

RECOGNIZING also that the constraints of the mission operations and of available resources may require different mechanisms for data exchange/sharing to be found for different programs;

CEOS members endorse the following principles relating to satellite data exchange in support of global change/climate and environmental research and monitoring and agree to work toward implementing them to the fullest extent possible. Principles for data exchange in support of other data uses beyond global change/climate and environmental research and monitoring will be developed for CEOS endorsement as a next step.

1) Preservation of all data needed for long-term global change/climate and environmental research and monitoring is required.

2) Data archives should include easily accessible information about the data holdings, including quality assessments, supporting ancillary information, and guidance and aids for locating and obtaining the data.

3) International standards—including those generated by the CEOS Working Group on Data—should be used to the greatest extent possible for recording/storage media and for processing and communication of data sets.

4) Maximizing the use of satellite data is a fundamental objective. An exchange/sharing mechanism among CEOS Members is an essential first step to maximize use.

5) Non-discriminatory access to satellite data by non-CEOS Members for global change/climate and environmental research and monitoring is essential. This should be achieved within the framework of the exchange and sharing mechanisms set up by CEOS Members.

6) Programs should have no exclusive period of data use. Where the need to provide validated data is recognized, any initial period of exclusive data use should be limited and explicitly defined. The goal should be release of data in some preliminary form within 3 months after the start of routine data acquisition.

7) Criteria and priorities for data acquisition, archiving, and purging should be harmonized.

APPENDIX G: ACRONYMS

A

ADEOS	Advanced Earth Observing System
AG	Analysis Group
ALOS	Advanced Land Observing System
AS	Access Subgroup
ASI	Agenzia Spaziale Italiano
ATLAS	Atmospheric Laboratory for Applications and Science
AVHRR	Advanced Very High-Resolution Radiometer

B

BNSC	British National Space Centre

C

CAST	Chinese Academy of Space and Technology
CBERS	China-Brazil Earth Remote-Sensing Satellite
CCB	Change Control Board
CCRS	Canada Centre for Remote Sensing
CCSDS	Consultative Committee on Space Data Systems
CCT	Computer-Compatible Tape
CEOS	Committee on Earth Observation Satellites
CILS	CEOS Information Locator System
CINTEX	CEOS Inventory Interoperability Experiment
CIP	Catalogue Interoperability Protocol
CLOS	Coordination on Land Observation Satellites
CLRSS	Coordination on Land Remote-Sensing Satellites
CNES	Centre National d'Etudes Spatiales
CORSS	Coordination on Ocean Remote-Sensing Satellites
CRI	Crown Research Institute of New Zealand
CSA	Canadian Space Agency
CSIRO	Commonwealth Scientific and Industrial Research Organisation

D

DARA	Deutsches Agentur für Raumfahrtangelegenheiten
DEM	Digital Elevation Model
DLR	Deutsches Zentrum für Luft- und Raumfahrt (German Aerospace Center)
DS	Data Subgroup

E

EC	European Commission
EO	Earth Observation
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
EROS	Earth Resources Observation System
ERS	European Remote-Sensing Satellite
ESA	European Space Agency
ESCAP	Economic and Social Commission for Asia and the Pacific
ESRIN	European Space Research Institute
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites

F

FAO	Food and Agriculture Organization

G

GCOS	Global Climate Observing System
GCOM	Global Change Observing Mission
GLOBE	Global Land One-km Base Elevation
GMS	Geostationary Meteorological Satellite
GOOS	Global Ocean Observing System
GSFC	Goddard Space Flight Center
GTOS	Global Terrestrial Observing System
G3OS	Global Observing Systems (Global Climate, Terrestrial and Ocean Observing Systems)

H

HRPT	High-Resolution Picture Transmission

I

IAF	International Astronautical Federation
IASI	Infrared Atmospheric Sounding Interferometer
ICSU	International Council of Scientific Unions
IDN	International Directory Network
IEOSC	International Earth Observations Satellite Committee
IFEOS	International Forum for Earth Observations using Space Station Elements
IGBP	International Geosphere-Biosphere Program
IGOS	Integrated Global Observing Strategy
IMOP	Imagery Optional

IMS	Information Management System
INPE	Instituto Nacional de Pesquisas Espaciais
INSAT	Indian National Satellite
IOC	Intergovernmental Oceanographic Commission
IRS	Indian Remote-Sensing Satellite
ISPRS	International Society on Photogrammetry and Remote Sensing
ISRO	Indian Space Research Organisation
ISY	International Space Year
IVOS	Infrared and Visible Optical Sensors

J

JERS	Japanese Earth Resources Satellite
JPL	Jet Propulsion Laboratory
JMA	Japanese Meteorological Agency

L

LAGEOS	Laser Geodynamics Satellite
LSPV	Land Surface Parameter Validation

M

MECB	Brazilian Complete Space Mission
MITI	Ministry of International Trade and Industry
MOPITT	Measurements of Pollution in the Troposphere
MOT	Ministry of Transport (Japan)
MOU	Memorandum of Understanding
MSG	Meteosat Second Generation
MTSAT	Multi-functional Transport Satellite

N

NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NESDIS	National Environmental Satellite, Data, and Information Service
NET	No earlier than
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NRSCC	National Remote Sensing Center of China
NS	Network Subgroup
NSAU	National Space Agency of Ukraine
NSC	Norwegian Space Centre

O

OSTC	Federal Office for Scientific, Technical, and Cultural Affairs of Belgium

P

POLDER	Polarization and Directionality of the Earth's Reflectances

R

ROSHYDROMET	Russian Federal Service for Hydrometeorology and Environmental Monitoring
RSA	Russian Space Agency
Rosaviakosmos	Russian Aviation and Space Agency

S

SAFISY	Space Agency Forum on International Space Year
SAR	Synthetic Aperture Radar
SCARAB	Scanner for the Radiation Budget
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Cartography
SeaWiFS	Sea-Viewing Wide Field-of-View Sensor
SIT	Strategic Implementation Team
SNSB	Swedish National Space Board
SPO	Belgian Space Policy Office
SPOT	Systeme Pour l'Observation de la Terre
SRL	Space Radar Laboratory
SSBUV	Shuttle Solar Backscatter Ultraviolet
STA	Science and Technology Agency of Japan

T

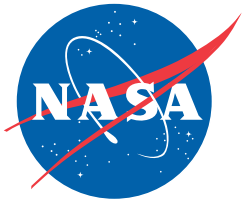
TDRSS	Tracking and Data Relay Satellite System
TIROS	Television Infrared Observing Satellite
TM	Landsat Thematic Mapper
TOMS	Total Ozone Mapping Spectrometer
TOPEX	Ocean Topography Experiment
TRMM	Tropical Rainfall Measuring Mission

U

UARS	Upper Atmosphere Research Satellite
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Program
UNOOSA	United Nations Office of Outer Space Affairs
USGS	US Geological Survey

W

WCRP	World Climate Research Programme
WG	Working Group
WGCV	Working Group on Calibration and Validation
WGD	Working Group on Data
WGINS	Working Group on International Network Services
WGISS	Working Group on Information Systems and Services
WGN	Working Group on Networks
WGSN	Working Group on Space-to-Ground Networks
WMO	World Meteorological Organization
WWW	World Wide Web



Published on behalf of CEOS by:
National Aeronautics and
Space Administration